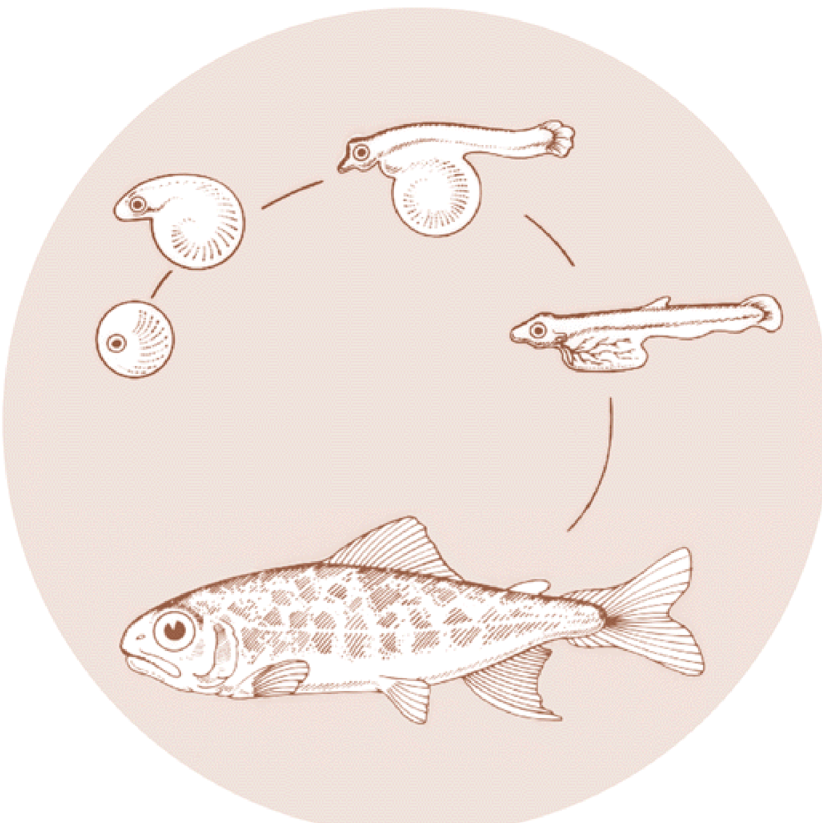
HOOD RIVER PRODUCTION PROGRAM MONITORING AND EVALUATION

Report A:
Hood River and Pelton Ladder Evaluation Studies

Report B:
Hood River and Pelton Ladder

Annual Report 1996



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HOOD RIVER PRODUCTION PROGRAM
MONITORING AND EVALUATION

Report A:
HOOD RIVER AND PELTON LADDER
EVALUATION STUDIES

Report B:
HOOD RIVER AND PELTON LADDER

Annual Reports for 1996

Report A
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REPORT A

HOOD RIVER AND PELTON LADDER EVALUATION STUDIES

ANNUAL PROGRESS REPORT
1996

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INTRODUCTION

In 1992. the Northwest Power Planning Council approved the Hood River and Pelton ladder master plans (O'Toole and Oregon Department of Fish and Wildlife 1991a, O'Toole and Oregon Department of Fish and Wildlife 1991b, and Smith and The Confederated Tribes of the Warm Springs Reservation of Oregon 1991) within the framework of the Columbia River Basin Fish and Wildlife Program. The master plans define an approach for implementing a hatchery supplementation program in the Hood River subbasin. The hatchery program, as defined in the master plans, is called the Hood River Production Program (HRPP). The HRPP will be implemented at a reduced hatchery production level until 1) the construction of all proposed hatchery facilities has been completed and 2) numbers of returning wild jack and adult fish are sufficient to meet broodstock collection goals. It is anticipated that construction on the hatchery production facilities will be completed by the spring of 1998. The HRPP is jointly implemented by the Oregon Department of Fish and Wildlife (ODFW) and the Confederated Tribes of the Warm Springs (CTWS) Reservation.

In December 1991, a monitoring and evaluation (M&E) program was implemented in the Hood River subbasin to collect life history and production information on stocks of anadromous salmonids returning to the Hood River subbasin. Data collected from the M&E program will provide the baseline information needed to (1) evaluate various management options for implementing the HRPP and (2) determine any post-project impacts the HRPP has on indigenous populations of resident fish. Information was also used in the preparation of an environmental impact statement (EIS; Bonneville Power Administration 1996a; Bonneville Power Administration 1996b) which was completed in 1997. The Bonneville Power Administration (BPA) prepared the EIS in compliance with federal guidelines established in the National Environmental Policy Act (NEPA).

The primary goals of the HRPP are (1) to increase subbasin production of wild summer and winter steelhead (*Oncorhynchus mykiss*) and (2) reintroduce spring chinook salmon (*Oncorhynchus tshawytscha*) into the Hood River subbasin (Figures 1 and 2). Harvest and escapement goals are identified in O'Toole and Oregon Department of Fish and Wildlife (1991a), O'Toole and Oregon Department of Fish and Wildlife (1991b), and Smith and The Confederated Tribes of the Warm Springs Reservation of Oregon (1991). Strategies for achieving the production goals were initially devised based on various assumptions about carrying capacity, survival rates, and escapement of stocks of anadromous salmonids in the Hood River subbasin. To obtain the information needed to more accurately estimate each parameter, an adult trap is operated at Powerdale Dam to collect life history and escapement information on stocks of anadromous salmonids entering the Hood River subbasin. The Oregon

Department of Fish and Wildlife funded themonitoring program at Powerdale Dam-beginning in December 1991. and Bonneville Power Administration took over the funding in August 1992.

The contract period for FY 96 was 1 October 1995 through 30 September 1996. Work implemented during FY 96 included (1) estimating natural production of juvenile and smolt rainbow-steelhead at selected sites in the Hood River subbasin, (2) monitoring spatial, distribution of wild adult anadromous salmonids in the Hood River subbasin, (3) monitoring selected life history characteristics and escapements of wild and hatchery produced anadromous salmonids, (4) estimating harvest of jack and adult anadromous salmonids below Powerdale Dam, (5) preparing, an annual report summarizing data collected during FY 96, and (6) continuing activities needed to construct an adult collection facility in the Hood River subbasin. This report summarizes the life history, escapement, and harvest data collected, during FY 96, in the Hood River subbasin. Data collected by this project will provide the information needed to (1) test the assumptions on which harvest and escapement goals for the Hood' River and Pelton ladder master plans are based and (2) develop biologically based management recommendations for implementing the HRPP in a manner that will protect indigenous populations of wild fish. Data on life history, escapement, and harvest will continue to be collected during both the development and execution of the Hood River Production Program.

METHODS

Juvenile Production

Downstream migrant anadromous salmonids were trapped at rotary-screw traps (i.e.. migrant trap) located in the mainstem Hood River (RM 4.5) and in the West (RM 4.0). Middle (RM 1.0). and East (RM 1.0) forks of the Hood River (Figure 3). Migrant traps were located at sites that would maximize both the flow into the trap and the amount of stream the trap would fish. To optimize trapping efficiency, traps were periodically repositioned in the stream channel to adjust for seasonal variation in streamflows. The mainstem migrant trap fished to a maximum depth of 1.2 meters, and the West, Middle. and East fork migrant traps fished to a maximum depth of 0.8 meters. The migrant traps fished approximately 8%, 9%, 14%. and 16% of the stream channels width in the mainstem, West Fork (WFk), East Fork (EFk), and Middle Fork (MFk), respectively.

The rotary-screw traps'funnel downstream migrants into a live box that was sampled on a daily basis. Sampling was usually conducted in the morning to reduce temperature related stress. All fish were anesthetized. sorted by species, examined for fin marks, and counted. Counts of downstream migrant rainbow-steelhead (rb-st) were made for two size categories: they included fish greater than or equal to 150 mm fork length and fish less than 150 mm fork length. Counts of downstream migrant juvenile wild chinook and coho salmon were made for three size categories; they included fish less than 50 mm fork length, fish 50-69 mm fork length, and fish greater than 69 mm fork length. A random sample of fish were sampled for scales, measured to the nearest millimeter fork length. and weighed to the nearest 0.1 gram. Scale samples were mounted on glass slides and sent to the ODFW's research laboratory in Corvallis, Oregon, where experienced ODFW staff analyzed the scales and determined freshwater age using methods described by Borgerson et al. (1992). Data was recorded on a computerized date entry form and keypunched into a computer database.

Downstream migrant salmonids were sampled at the mainstem migrant trap to monitor temporal distribution of migration from the Hood River subbasin. Estimates of migration timing were based on bi-weekly counts at the migrant trap. Bi-weekly counts were not adjusted for seasonal variation in trap efficiency because a low recapture rate made it impossible to accurately estimate trap efficiency for each bi-weekly time period.

Rainbow-steelhead were used to indirectly estimate steelhead smolt migration timing because no accurate methodology exists to visually identify rainbow trout from downstream migrant steelhead smolts. To estimate migration timing for steelhead smolts. it was also necessary to define a cutoff date in which the majority of smolts should have migrated past the trapping facility. The ending date for the steelhead smolt migration was fixed at 31 July based on the distribution of bi-weekly catches of migrant rb-st.

We used mark and recapture methods to estimate abundance of wild, natural, and hatchery produced anadromous salmonid smolts that migrated from the Hood River subbasin. Estimates of smolt production for wild and naturally produced salmonids were limited to the upper size category because'outmigrant smolts are believed to predominately be the larger size fish. A pooled Petersen estimate with Chapman's modification (Ricker 1975) was used to estimate numbers of downstream migrants, by species and size category, as follows:

$$\hat{N} = \frac{(M+1)(C+1)}{(R+1)}$$

where

$\hat{N}$ = estimated number of migrants leaving the Hood River subbasin,
M = number of migrants marked and released above the rotary-screw trap,
C = total number of migrants captured at the rotary-screw trap, and
R = number of marked migrants recaptured at the rotary-screw trap.

Approximate 95% confidence intervals (C.I.) were calculated as follows (Seber 1973. cited by Lindsay et al. 1986; Ott 1977, cited by Lindsay et al. 1986):

$$95\%\ C.I. = \hat{N} \pm 2\sqrt{\hat{V}(\hat{N})} \quad \text{and}$$

$$\hat{V}(\hat{N}) = \left(\frac{M^2\ B^2}{R^4}\right) R \left(1-\frac{R}{M}\right) + \left(\frac{M^2}{R^2}\right) B \left(1-\frac{B}{\hat{N}-M}\right)$$

where

$\hat{V}(\hat{N})$ = variance of estimated migrant abundance and
B = number of unmarked migrants in the recapture sample (C - R).

Downstream migrants were marked with a panjet needle-less injector. The panjet was used to shoot a narrow high speed stream of colored dye at selected fins. This process permanently marked the fin with a unique color code by infusing a small amount of the colored dye below the epidermal layer. The dye color and marked fin combination was changed every two weeks to uniquely mark fish at defined time intervals throughout the sampling period. Unique dye color and marked fin combinations were also assigned to each trap so that the origin of recaptures at the mainstem migrant trap could be determined.

Population estimates were made in selected reaches of stream located throughout the Hood River subbasin (Figure 3) to estimate rearing abundance of anadromous and resident salmonids. Streams were selected based on two primary criteria: (1) the stream had habitat that was potentially accessible to anadromous salmonids and (2) randomly selected reaches of stream would have a reasonable chance of effectively being sampled to estimate population numbers of resident fish. The length of each reach of stream sampled was approximately 60 meters. The

60 meter length ensured that the sampling reach was long enough to include several different habitat types, but not so long that it could not be effectively sampled in one work day. A survey reaches upstream end was generally located just below a riffle and the downstream end was generally located just above a riffle. Both ends of the survey reach were blocked with 3 millimeter mesh seines to prevent both immigration and emigration of fish.

A three pass removal method was used to estimate population numbers in virtually all the sampling reaches (Zippin 1958; Seber and Whale 1970). The population estimate and probability of capture for the three pass removal method (Seber and Whale 1970) were estimated as follows:

$$\hat{N} = \frac{6X^2 - 3XY - Y^2 + Y(Y^2 + 6XY - 3X^2)^{.5}}{18(X - Y)} \text{ and}$$

$$\hat{p} = \frac{3X - Y - (Y^2 + 6XY - 3X^2)^{.5}}{2X}$$

where

$\hat{N}$ = population size,

$\hat{p}$ = probability of capture,

$X = 2y_1 + y_2$,

$Y = y_1 + y_2 + y_3$,

y_1 = fish counted in pass 1.

y_2 = fish counted in pass 2. and

y_3 = fish counted in pass 3.

A two pass removal method was used to estimate population numbers in several sampling reaches (see APPENDIX A). The population estimate and probability of capture for the two pass removal method (Zippin 1958) were estimated as follows:

$$\hat{N} = \frac{y_1^2}{y_1 - y_2} \quad and$$

$$\hat{p} = \frac{y_1 - y_2}{y_1}$$

where

$\hat{N}$ = population'size.

$\hat{p}$ = probability of capture,

y_1 = fish counted in pass 1. and

y_2 = fish counted in pass 2.

The 95% confidence limits (Zippin 1958) for both the two and three pass removal methods were estimated as follows:

$$SE(\hat{N}) = \sqrt{\frac{\hat{N}(\hat{N}-T)T}{T^2 - \hat{N}(\hat{N}-T)\frac{(k\hat{p})^2}{1-\hat{p}}}} \quad and$$

$$95\%\ C.I. = \hat{N} \pm 2\ SE(\hat{N})$$

where

T = total catch and
k = number of trappings.

Fish were collected using one to four Smith-Root programmable output wave backpack electrofishers. The number of backpack shockers used in a sampling reach was dependent on stream width. Fish collected in each pass were held separately in live boxes. After the final pass, fish were anesthetized and counted by species. Rainbow-steelhead and cutthroat trout were additionally sorted into one of two defined size grdups (i.e.. less than 85 mm fork length and greater than and equal to 85 mm fork length) and counts were made for each size group. The 85 mm fork length break point was designed to correspond with the estimated upper size distribution of age-0 steelhead and trout. A random sample of fork lengths and weights were taken for each species of fish sampled in the stream reach. Fork length was measured to the nearest millimeter and weight was measured to the nearest 0.1 gram. Data was recorded on a computer form and keypunched into a computer database.

Volume and surface area was estimated for each stream reach sampled for abundance and biomass. Estimates were derived by dividing the planar area of the stream reach by 11 equidistant parallel transects of length $y_1, y_2, y_3, \ldots y_{11}$ starting at the head of the sampling reach. Lengths were measured to the beginning of the water line on each side of the stream bank, perpendicular to the stream. With the exception of five stream reaches sampled in 1994, five depth measurements (i.e.. d_1, d,, . . d_5) were taken along each transect at intervals of 1. 3. 5, 7, and 9 tenths of the width (w) of the transect line. In 1994, four depth measurements (i.e.. $d_1, d_2, \ldots d_4$) were taken along each transect at intervals of 1, 3. 5, and 7 eights of the width of the transect line in Neal (RM 5), McGee, Elk, and Bear creeks and in Ddg River.

The 11 equidistant parallel transects of common height (h) formed 10 trapezoids and, depending on the number of depth measurements taken (i.e.. four or five), either fifty or sixty hexahedrons. The area of each trapezoid was estimated using the formula: $\frac{1}{2}*(h)*(y_n+y_{(n+1)})$. The volume of each hexahedron was estimated using the formula:

$$\text{Volume} = \tfrac{1}{3} * L * (G_1 + G_2 + (G_1*G_2)^{.5}), \text{ and}$$

$$G_n \text{ (Area)} = \tfrac{1}{2} * w * (d_n + d_{n+1})$$

where

L = length of the hexahedron,
G_1 = area of the plane formed by the face of the upriver side of the hexahedron.
G_2 = area of the plane formed by the face of the downriver side of the hexahedron,
w = width of the hexahedron. and
d_n = depth measurement at interval n along the transect line.

Surface area for the entire sampling reach was estimated as the sum of the surface areas for the 10 trapezoids. Volume for the entire sampling reach was estimated as the sum of the volumes for each hexahedron.

Adult Trapping

An upstream migrant adult fish trap (Powerdale Dam trap) was installed at Powerdale Dam in December 1991. Powerdale Dam, which is owned and operated by PacifiCorp, is located at RM 4.5 in the mainstem Hood River (Figure 1). Powerdale Dam trap was installed in the uppermost pool of an existing fish ladder located on the east bank of the mainstem Hood River. The stop-log water intake control of the fish ladder was modified to allow water to flow through a submerged orifice into the ladder. A removable bar grate with one inch spaces between bars blocked the submerged orifice to prevent fish from exiting the top pool of the ladder. A fyke, installed at the entrance to the uppermost pool, prevented fish from backing down the ladder after they entered the uppermost pool. A wood slat cover was put on the trap to prevent fish from jumping out of the trap and a lock on the cover prevented poaching. A false floor of wood slats was installed at the bottom of the trap to reduce the depth of the trap from about 4.5 feet to about 2 feet. This modification facilitated removal of the fish. In June 1992, the submerged fyke was replaced with a finger weir because it was observed that spring chinook salmon would avoid swimming through the submerged fyke and would often try to jump over it. There was no delay in migration timing, or other abnormal fish behavior, observed with the new design.

The Powerdale Dam trap has been operated daily since December 1991 except during the winter when low stream temperatures slow upstream migration. Generally, the trap is checked in the morning to minimize potential handling stress associated with sampling fish during the afternoon when water temperatures are typically higher.

Jack and adult salmonids were identified by species, classified by sex, and examined for injuries. Injuries were categorized as either a predator scar, net mark, hook scar, or a scrape. Predator scars included both closed and open wounds. A closed wound was typically an "M" shaped marine mammal scar where scales were missing and the skin was scratched. An open wound was one in which the skin was broken. Net marks were distinguished by a raw. rubbed mark on the leading edge of the dorsal fin. Generally, marks from the net twine could be seen encircling the fish. Hook scars included both fresh and healed wounds. Fresh hook scars were any wound in the area of the mouth in which the skin was torn or abraded. Healed hook scars were often a missing maxillary or deformed jaw. A wound was classified as a scrape if the skin was either scratched or abraded, or the scales were missing, and the wound did not appear to be the result of a predator.

Spring and- fall races of chinook salmon were distinguished based on run timing, external coloration, and general appearance. Summer and winter races of steelhead were distinguished based on fin marks, external coloration, degree of scale tightness and scale erosion, state of sexual maturity relative to the time of year, external parasite load, color of gill filaments, and general appearance. Fish were anesthetized with CO, before the physical examination. Subsequent to the physical examination, each fish was measured to the nearest 0.5 cm fork length, weighed to the nearest 0.1 kg, and tagged with a numbered anchor tag below the base of the dorsal fin. A random sample of unmarked adult coho salmon and summer and winter steelhead were radio tagged on a predefined schedule. Sumner steelhead were collected from the 1995-96 run year and were predominately tagged during FY 95. The radio tagging schedule was designed to ensure that adults were collected from throughout the entire run and in proportions that generally mirrored migration timing. Field data was entered on a computer form and keypunched into a database.

Fecundity was estimated for wild and hatchery winter steelhead from adults used as hatchery broodstock. Females used for hatchery broodstock were air spawned and the number of eggs per female was estimated with a volumetric displacement technique. Estimates were not adjusted to account for potential egg retention.

Scale samples were collected from almost all jack and adult salmonids sampled at the Powerdale Dam trap. Samples were collected from the key scale area on each side of the fish and placed into uniquely numbered scale envelopes. Scale samples were later mounted on gummed cards and sent to the ODFW's research laboratory in Corvallis, Oregon, where an acetate impression was made of each card. Impressions were viewed by microfiche. Experienced ODFW staff analyzed the impressions and determined origin (wild or hatchery) and life history (freshwater and ocean ages) using methods described by Borgerson et al. (1992).

Sumner and winter races of steelhead were classified as wild or hatchery fish based on mark combination and scale analysis. Scale analysis was used in all cases to determine if unmarked fish were "wild" or "hatchery" produced. "Wild" unmarked summer and winter steelhead were assumed to be returns from wild production in the Hood River subbasin. "Hatchery" adipose-marked summer steelhead were assumed to be returns from subbasin hatchery production releases because all hatchery summer steelhead smolts are adipose-clipped prior to release in the Hood River subbasin (see HATCHERY PRODUCTION). "Hatchery" marked summer steelhead with other mark combinations were classified as stray hatchery fish.

"Hatchery" unmarked winter steelhead returning from brood releases made prior to the 1989 brood release were assumed to be returns from subbasin hatchery production. This assumption was made because, prior to the 1989 brood release, all hatchery winter steelhead production was released unmarked Into the Hood River subbasin. Hatchery production releases in the Hood River subbasin were first marked beginning with the 1989 brood release (*see* HATCHERY PRODUCTION). The entire hatchery production release from the 1989 brood, as well as all subsequent hatchery brood releases, were marked prior to release in the Hood River subbasin. With the exception'of the 1993 and 1994 brood releases, alternate brood releases were marked with a unique mark combination. "Hatchery" marked winter steelhead were classified as either a subbasin or stray hatchery fish based on mark combination and age.

Scale analysis identified a number of unmarked steelhead as "hatchery" fish and marked steelhead as "wild" fish (i.e.. origin unknown). The latter group includes marked wild and natural strays and Hood River stock wild steelhead which either had deformed fins or had the fins removed by sport fishers. Fin removal, by fishers, has been observed in the Hood River subbasin (personal communication on 11/17/93 with Jim Newton, Oregon Department of Fish and 'Wildlife, The Dalles, Oregon). The former group includes steelhead that were either mis-classified as hatchery fish or were unmarked hatchery fish. "Hatchery" unmarked steelhead are believed to primarily be returns from subbasin hatchery production releases because of problems associated with the poor marking of hatchery smolts; a problem primarily associated with the hatchery winter steelhead program. Numbers of adult 'steelhead in both of these groups was typically low.

Steelhead of unknown origin were not used in estimating the migration timing, sex ratio, or age structure of wild, subbasin hatchery, and stray hatchery fish in order to minimize the potential for biasing estimates by incorporating fish of unknown origin into the sample populations. For purposes of estimating escapement, however, all "wild" marked steelhead were allocated as wild fish and all "hatchery" unmarked steelhead were allocated as Hood River subbasin hatchery production. Steelhead with regenerated scales, as well as those for which no scale samples were taken, were classified as wild, if they were unmarked, and as either subbasin or stray hatchery fish, based on mark.combination. Steelhead. for which the age was unknown, were allocated into specific age categories using the ratio's observed in the corresponding category of wild, subbasin hatchery, and stray hatchery fish in which they were assigned.

Spring chinook salmon were classified as natural or hatchery fish based on fin mark and scale analysis. Scale analysis was'used in all cases to determine if a fish was "natural" or "hatchery" produced. "Natural" unmarked spring chinook salmon were assumed to be returns from natural subbasin production. "Hatchery" unmarked spring chinook salmon returning from the 1986-90 and the 1993 broods were assumed to be returns from subbasin hatchery production releases. This assumption was made because only a percentage of these brood releases were marked prior to release in the Hood River subbasin. Hatchery production releases from the

1991 and 1994 broods were entirely marked. "Hatchery" marked spring chinook salmon were classified as either a subbasin or stray hatchery fish based on mark combination and age. Migration timing, sex ratio, age structure, and escapements were estimated using the same methods described for summer and winter steelhead.

Fall chinook salmon and coho salmon (*Oncorhynchus kisutch*) were classified as natural or hatchery fish based on mark combination and scale analyses. Unmarked fall chinook and coho salmon, classified as wild fish based on scale analysis, were assumed to be returns from subbasin natural production. Unmarked and marked fall chinook and coho salmon, classified as hatchery fish based on scale analysis, were assumed to be strays because no hatchery fall chinook or coho salmon are released into the Hood River subbasin. Migration timing, sex ratio, age structure, and escapements were estimated using the same methods described for summer and winter steelhead.

Harvest Estimates

Creel surveys were conducted on the Hood River from 1 January through 31 December 1996. The survey area extended from the mouth of the Hood River to the reach of stream which could be visually observed from atop Powerdale Dam (i.e.. approximately RM 4.7). The creel was limited to this reach of stream because punch card returns indicate the greater percentage of fish (approximately 75% or more> are harvested in this area and because our ability to accurately estimate harvest above Powerdale Dam is limited both by the diversity of access points and the low numbers of anglers which fish above the dam. Access to the survey area below Powerdale Dam is primarily limited-to three main sites.

Angling in the Hood River subbasin is allowed all year-around for summer and winter steelhead and spring and fall chinook salmon. The angling season for coho salmon was open from 1 September through 31 December, and for trout from 25 May through, 21 October. Anglers were not allowed to keep unmarked summer and winter steelhead or unmarked trout. Summer and winter steelhead with an adipose fin clip, marked hatchery trout, and both marked and unmarked spring and fall chinook salmon and coho salmon could be harvested. Daily bag limit in the Hood River subbasin was restricted to 1) five trout per day and 2) a combined catch of two adult salmon and steelhead per day. The combined annual bag limit for salmon and steel head was forty adults in 1996.

Two levels of stratification (day type and two week period) were used in summarizing the data and estimates of catch, catch rate, and effort were determined for both strata. Sampling days were categorized as either a weekend-holiday or week day and total catch was summarized by two week periods (bi-monthly) that encompassed the first through the fifteenth and the sixteenth through the end of each month. Days assigned as holidays are listed in Table 1 for 1996. In general, 40-75% of the weekdays and 40-65% of the weekend-holiday days were sampled in each two week period.-

Hours of effort for each sample day (H_i) were estimated by developing a pressure curve from periodic pressure counts and calculating area under the curve as follows:

$$H_i = 1/2 \sum_{k=1}^{r} \left[(T_k - T_{k-1}) (C_k + C_{k-1}) \right]$$

where

r = number of pressure counts per day,
C_k = angler count at the k^{th} pressure count, and
T_k = time at the k^{th} pressure count.

Table '1. Holidays summarized as weekend days in 1996.

Day	Holiday
01/01	New Years
01/15	Martin Luther King day
02/19	Presidents day
05/27	Memorial day
07/04	Fourth of July
09/02	Labor day
11/11	Veterans day
11/28	Thanksgiving
12/25	Christmas

The first and last pressure counts were considered as zero points and were assumed to be ½ hour before sunrise and ½ hour after sunset. Pressure counts were conducted three times during the day. Times were determined by dividing the sampling day into three equal length periods and conducting a pressure count at the point when angler numbers appeared to be the highest during the period. The direction of surveyor travel for the first pressure count was randomly selected. Subsequent pressure counts were made in the opposite direction of the previous count. Anglers were interviewed throughout the day to obtain catch rate information on both fishers that had completed angling as well as for those that had not completed angling. The catch rate in fish per angler hour on day i (R_i) was estimated by:'

$$R_i = \sum_{j=1}^{m_i} f_{ij} \Big/ \sum_{j=1}^{m_i} h_{ij}$$

where

m_i = number of anglers interviewed on the i^{th} day,
f_{ij} = number of fish caught by the j^{th} angler on the i^{th} day, and
h_{ij} = number of hours fished by the j^{th} angler on the i^{th} day.

Total daily catch in numbers of fish on day i (TC_i) was estimated by:

$$TC_i = (R_i)(H_i)$$

Total catch for a given stratum (TC_s) was estimated by:

$$TC_s = (N/n) \sum_{i=1}^{n} TC_i$$

where

N = number of days within a stratum and
n = number of days sampled within a stratum.

Variance for the estimate of total catch in a given stratum [$V(TC_s)$] was estimated by:

$$V(TC_s) = N^2(1-(n/N))(S_b^2/n) + N/n \sum_{i=1}^{n} \left[(1-(\sum_{j=1}^{m_i} h_{ij})/H_i)(H_i^2)(S_w^2/m_i) \right]$$

where

$$S_b^2 = \sum_{i=1}^{n} (TC_i-\overline{TC})^2/(n-1) \qquad \textit{(i.e., between day variance)},$$

$$\overline{TC} = \sum_{i=1}^{n} TC_i/n, \textit{ and}$$

$$S_w^2 = \sum_{j=1}^{m_i} (f_{ij}/h_{ij}-R_i)^2/ \quad (m_i-1) \qquad \textit{(i.e., within day variance).}$$

Total catch in a given stratum was allocated to defined categories of fish (i.e.. wild summer steelhead kept, wild summer steelhead released, subbasin hatchery summer steelhead kept, etc.) based on the proportion that each category of fish was represented in the known catch. The proportion in which a category of fish was represented in the stratum catch (p_s) was estimated as follows:

$$p_s = \sum_{i=1}^{n} \left[\frac{H_i}{\sum_{i=1}^{n} H_i} * p_i \right]$$ *(includes oniy those days in which fish were caught)*

where

p_i = the proportion of fish caught on the i^{th} day for a given category of fish.

Daily proportions (p_i) for a given category of fish were estimated as follows:

$$p_i = \sum_{j=1}^{m_i} fc_{ij} / \sum_{j=1}^{m_i} f_{ij}$$

where

fc_{ij} = number of fish caught by the j^{th} angler on the i^{th} day for a given category of fish.

Variance for the estimate of the proportion of fish caught in a given category, and stratum $[V(p_s)]$, was estimated by:

$$V(p_s) = \frac{N - n_p}{N n_p \bar{\bar{H}}_s} * \frac{\sum_{i=1}^{n} (H_i p_i)^2 - 2 p_s \sum_{i=1}^{n} (H_i^2 p_i) + p_s^2 \sum_{i=1}^{n} (H_i^2)}{(n_p - 1)}$$

$$+ \frac{1}{N n_p \bar{\bar{H}}_s} * \sum_{i=1}^{n} \left[H_i^2 \frac{(H_i - h_i)}{H_i} * \frac{(p_i)(1 - p_i)}{\sum_{j=1}^{m_i} f_{ij}} \right]$$

where

$\overline{H_s}$ = *mean daily effort for the stratum and*

n_p = *number of days sampled in the stratum when fish were caught (i.e., the basis for estimating p_s).*

Variance in the estimate of catch for a given category of fish caught within a given stratum [$V(C_s)$] was derived by:

$$V(C_s) = V(p_s)*(TC_s)^2 + V(TC_s)*(p_s)^2 - V(p_s)*V(TC_s)$$

Estimates of total catch (TC) and the variance in the estimate of total catch [V(C)], for a given category of fish, was determined by summing the corresponding stratum estimates, Approximate 95% confidence intervals (C.I.), for a given category of fish, were calculated as follows:

$$95\%\ C.I. = TC \pm 2\sqrt{V(C)}$$

Number of anglers fishing in each stratum was estimated by dividing total effort in the stratum by the mean estimate of effort for anglers that had completed fishing within the stratum. Estimates of the number of anglers fishing within each stratum were summed to estimate the numbers of anglers fishing within the corresponding bi-monthly period. Formulas used for estimating harvest and 95% confidence intervals were from Carmichael et al. (1988) and from notes dated 05/28/97 from Mary Buckman, Oregon Department of Fish and Wildlife, Corvallis, Oregon.

RAINBOW-STEELHEAD

Natural Production

Reaches of stream were sampled at various sites located throughout the Hood River subbasin (Figure 3) to estimate rearing abundance of rainbow trout and steelhead. Because no accurate methodology exists to differentiate between juvenile and 'adult rainbow trout and steelhead. these two species will be categorized as rainbow-steelhead (rb-st) throughout the rest of this report.

Rainbow-steelhead were recovered at all sampling sites with the exception of Robinhood Creek (Table 2; see Appendixes A and C). In 1996, rainbow-steelhead generally represented a greater proportion of the total biomass (grams/m^3), in reaches of stream with both rb-st and cutthroat trout, with the single exception. of the reach of stream sampled in Dog River (see CUTTHROAT TROUT). As i,n previous years, the reach of stream sampled in Greenpoint Creek supported the greatest amount of total rb-st biomass (Table 2) with an estimate of biomass 5% higher than the next highest estimate.

A juvenile migrant trap was operated at RM 4.5 in the mainstem Hood River to estimate the number of downstream migrant rb-st leaving the Hood River subbasin. An estimated 8,742 rb-st greater than or equal to 150 nun passed the migrant trap from 3 April through 31 July 1996 (Table 3). Estimates of the number of downstream migrant rb-st do not include production from Neal Creek, which is a major tributary draining into a side channel opposite the migrant trap: Downstream migrant rb-st were predominately freshwater age-2 fish (70.5%).

No accurate methodology exists to visually identify downstream migrant rb-st as either steelhead smolts. steelhead pre-smolt migrants, or resident rainbow trout. Consequently, it is difficult at this time to develop a statistical estimate of smolt production for the subbasin. An estimate of subbasin smolt production wasdeveloped by adjusting the estimate of downstream migrant rb-st based on information available from adult scale analysis (see ADULT SUMMER STEELHEAD, Age Composition, Size, and Sex Ratio; ADULT WINTER STEELHEAD, Age Composition, Size, and Sex Ratio) and age specific length frequency of downstream migrant rb-st (see JUVENILE RAINBOW-STEELHEAD, Size and Weight).

Freshwater age-0 migrant rb-st were assumed not to be smolts based on the fact that no returning adults have had a sub-yearling smolt life history pattern. Numbers of steelhead migrating as freshwater age-l, age-2. and age-3 smolts was determined based on the ratio between the number of rb-st migrants less than or equal to 165 mm fork length and the number greater than 165 mm fork length in the corresponding age category. The 165 mm fork length size break was developed based on the minimum size of age-3 rb-st collected at the mainstem migrant trap in 1994. The minimum size of age-3 downstream migrant rb-st was used to develop the size break based on three primary assumptions: (1) that most freshwater age-3 migrants are steelhead smolts; (2) that physiological changes associated with the smolting process are, in part, initiated by size; and (3) that the size range of freshwater age-3 migrant rb-st in the sample population is an indicator of the size range of downstream migrant steelhead smolts. In 1994, the smallest freshwater age-3 downstream migrant sampled at the mainstem migrant trap was 168 mm fork length (Olsen et al. 1995). Based on this minimum measurement, all downstream migrants greater than 165 mm fork length were assumed to be steelhead smolts.

Data collected in 1994 was used to develop the size break, rather than data collected from 1995-96. because it represents a more conservative approach for estimating the minimum size range of downstream migrant steelhead smolts. The size range of age-3 rb-st sampled in both 1995 and 1996 included several juveniles smaller than 165 mm fork length. Data collected from adult scale analysis, however, indicates that a small percentage of steelhead migrate as freshwater age-4 smolts (Table 4). The 165 mm fork length size break provides the basis for adjusting the freshwater age-3 category to account for downstream migrant pre-smolts that will remain in freshwater for an additional year prior to migration as smolts.

An estimated 6,779 steelhead smolts (Table 5) migrated past the juvenile migrant trap from'3 April through 31 July based on the above criteria. The age structure of downstream migrant steelhead smolts was estimated as 12%. 70%. 18%. and 0.3% freshwater age-l, age-2. age-3, and age-4, respectively (Table 5). The ratio of freshwater age categories was markedly higher for freshwater age-l and similar for freshwater age-2 and freshwater age-3 migrant smolts when compared with run year specific estimates derived from adult scale analysis (Tables 4 and 5). It is unknown what the underlying cause might be for the large. difference between the two estimates for the freshwater age-l category. Differences may be attributed to a combination of (1) the criteria used to estimate freshwater age-l steelhead smolts. (2) brood strength, or (3) a significantly lower smolt-to-adult survival rate for freshwater age-l smolts than for older age smolts.

Size and Weight

Estimates of mean fork length and condition factor are summarized for resident rb-st in Table 6. Estimates, by age category, of mean fork length, weight, and condition factor are summarized for downstream migrant rb-st in Table 7. Length x weight regressions for resident rb-st are presented in Figures 4-6 and Appendix Table D-1, and for downstream migrant rb-st in Figure 7. A length frequency histogram for downstream migrant rb-st is sununarized by age category in Figure 8.

Mean fork length of freshwater age-l, age-2. and age-3 downstream migrant rb-st was less than the mean fork length of yearling hatchery summer and winter steelhead smolts sampled at the mainstem migrant trap (Table 7: see HATCHERY PRODUCTION, Size and Weight), Mean condition factor of downstream migrant rb-st was less than Hood River stock hatchery winter steelhead sampled at Oak Springs Hatchery, prior to release, but similar to the mean condition factor of summer and winter steelhead smolts sampled at the mainstem migrant trap (Table 7; see HATCHERY PRODUCTION, Size and Weight).

Smolt Migration Timing

Peak steelhead smolt migration was estimated to occur from May to mid-June (Figure 9). Freshwater age-3 rb-st appeared to migrate earlier than the other age categories (Figure.9). freshwater age-l and age-2 rb-st migrated throughout the entire sampling period.

CUTTHROAT TROUT

Natural Production

Cutthroat trout were recovered in four of a total'10 reaches of stream sampled in the subbasin in 1996 (see Appendixes A and C). No rainbow-steelhead were found in one of the four reaches of stream. Robinhood Creek was the most productive cutthroat trout stream sampled, based on total biomass (i.e.. grams/m^3; Table 8). The estimate of biomass for Robinhood Creek was 296% higher than the next highest estimate made in 1996 which was for the reach of stream sampled in Dog River.

Twenty four downstream migrant cutthroat trout were captured in the mainstem migrant trap and no adult cutthroat trout were captured in the Powerdale Dam trap in 1996 (unpublished. data on 12/31/96 from Research and Development Section, Oregon Department of Fish and Wildlife, The Dalles, Oregon). The low number of cutthroat trout caught in the mainstem migrant trap from 1994-96. and the fact that no adult migrants have been caught in the Powerdale Dam trap since 1992, indicates the anadromous form of this species may be at a severely depressed level in the Hood River subbasin.

Size and Weight

Estimates of mean fork length and condition factor are summarized for resident cutthroat trout in Table 9 and for downstream migrants in Table 10. Length x weight regressions for resident cutthroat trout are presented in Figure 10 and Appendix Table D-2.

ADULT SUMMER STEELHEAD

Migration Timing

Wild and subbasin hatchery (Foster/Skamania stock) summer steelhead begin entering the Powerdale Dam trap in the last two weeks of March and a given run year encompasses two calendar years for both components of the run (Tables 11 and 12). The median migration date occurred during July for the wild run and from the last two weeks of June to the first two weeks of July for the subbasin hatchery run. Migration to the Powerdale Dam trap was completed by late April to early May of the second calendar year for both the wild and subbasin hatchery components of the run (Table 12).

Harvest, Escapement, and Survival

In the sampling area, sport fishers caught and released an estimated 261 and 55 wild and subbasin hatchery summer steelhead. respectively, and harvested an estimated 817 subbasin hatchery summer steelhead in 1996 (Table 13). Estimates of the number of caught and released stray hatchery summer steelhead are in APPENDIX F. Peak harvest occurred from late March to late July. A preliminary estimate of the exploitation rate indicates that in the sampling area sport fishers harvested approximately 3538% of the subbasin hatchery summer steelhead component of the 1996-97 run year returning to the Hood River subbasin.

Estimates of summer steelhead escapements to the Powerdale Dam trap ranged from 132-492 wild, 545-1.673 subbasin hatchery, and 5-56 stray hatchery fish for the 1992-93 through 1995-96 run years (Table 14). All wild and subbasin hatchery summer steelhead returning to the Powerdale Dam trap are released above Powerdale Dam.

The first complete brood returns were available for the 1990 brood subbasin hatchery summer steelhead upon completion of the 1995-96 run year. Preliminary estimates of post-release survival from smolt-to-adult return at the Powerdale Dam trap indicate that survival was fairly low for the 1990 hatchery brood release (Table 15). In general, data indicates that smolt to adult survival back to Powerdale Dam averages around 1.5-2X. and around 2.5-3X back to the mouth of the Hood River when adjusted for an estimated 38X harvest rate below Powerdale Dam. Estimates of post-release survival ranged from 0.4-6.6%, and. averaged 3.6X back to the mouth of the Deschutes River for the 1978-80 brood production releases of Deschutes stock hatchery summer steelhead in the Deschutes River subbasin (Olsen et al. Undated). While estimates of post-release survival back to the mouth of the Hood

River are not much less than the average estimate for the Deschutes River subbasin. the difference would probably be more profound if estimated survival rates to the Deschutes River were adjusted to account for'mortality, and further potential for straying. between the mouth of the Hood and Deschutes river subbasins. Post-release survival back to the Deschutes River subbasin is subject to losses associated with (1) mainstem Columbia River fisheries located between the mouth of the Hood and Deschutes rivers, (2) the negotiation of one additional mainstem Columbia River dam (i.e.. The Dalles Dam). and (3) increased potential for straying.

The low numbers of adult summer steelhead returning from the off station release of Foster stock hatchery smolts directly into the Hood River subbasin. may be the result of a variety of inter-related factors which negatively impact one or more life history stages. Several factors which may significantly contribute to a low rate of return include: 1) a high' in-basin post-release smolt mortality rate associated with the cumulative effects of stress prior to, and shortly after, release, 2) the possible poor homing ability of returning hatchery adults, and 3) any inherent reduction in the genetic fitness of the hatchery stock. While the exact cause, or causes, of the low rate of return are unknown, it isbelieved that the percentage of adult summer steelhead returning from a given brood release will be improved both by developing the hatchery broodstock from the wild component of the summer steelhead run (see Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Undated) and by acclimating hatchery smolts from one to four weeks prior to release (i.e., a volitional release> in the Hood River subbasin. Acclimation facilities will be developed at selected sites in the subbasin upon full implementation of the Hood River Production Program.

Age Composition, Size, and Sex Ratio

Wild summer steelhead migrate mainly as freshwater age-2 and age-3 smolts and return mainly as 2-salt adults (Table 16; see RAINBOW-STEELHEAD. Natural Production). Virtually all subbasin hatchery smolts migrate in the year of release (i.e.. freshwater age-l) and return. mainly as 2-salt adults (Table 16). Only one adult,subbasin hatchery summer steelhead has been sampled to date with a scale pattern indicating that as a juvenile the fish remained in freshwater for an additional year prior to migration as a smolt: An estimated 1.7-7.4% of the wild adults and 0.6-1.4% of the subbasin hatchery adults returned as repeat spawhers (Table ,161. All repeat spawners sampled from the 1995-96 run year had only a single spawner check (Table 17).

Mean fork length of wild summer steelhead without a spawning check ranged from 51-60 cm for l-salt adults, 64-70 cm for Z-salt adults, and 79-88 cm for 3-salt adults and was 79 cm for 4-salt adults (Tables 18 and 19). Mean fork length of subbasin hatchery summer steelhead without a spawning check ranged from 53-57 cm for l-salt adults, 66-75 cm for 2-salt adults, 78-81 cm for 3-salt adults, and 79-90 cm for 4-salt adults (Tables 18 and 19).

Mean weight of wild summer steelhead without a spawning check ranged from 1.6-2.3 kg for 1 salt adults, 3.2-3.6 kg for 2-salt adults, and from 5.0-5.3 kg for 3-salt adults (Tables 20 and 21). Mean weight of subbasin hatchery summer steelhead without a spawning check ranged from 1.6-2.0 kg for 1 salt adults, 2.9-4.1 kg for 2-salt adults, and from 5.1-5.2 kg for 3-salt adults (Tables 20 and 21).

Sex ratios varied among age categories and run year for both wild and subbasin hatchery summer steelhead (Table 22). In general, 2-salt adults returned predominately as females and 3-salt adults predominately'as males (Table 22).

Spatial Distribution

Nineteen unmarked and five marked summer steelhead. randomly selected from throughout the 1995-96 run year, were tagged with radio transmitters. All unmarked summer steelhead were classified as wild based on scale analysis. All marked summer steelhead were classified as subbasin hatchery summer steelhead based on scale analysis and fin mark. Seven tagged summer steelhead remained in the mainstem Hood River throughout the sampling period (Figures 11-21). A total of 14 summer steelhead moved into the WFk Hood River and three into the EFk Hood River. Two summer steelhead. detected in the WFk Hood River, moved into Lake Branch during October and November. One was later detected back in the WFk Hood River near the mouth of Lake Branch (Figures 11-21). One summer steelhead, detected in the WFk Hood River. moved into Greenpoint Creek in December (Figure 17).

ADULT WINTER STEELHEAD

Migration Timing

Winter steelhead begin entering the Powerdale Dam trap as early as the last two weeks of November and a given run year may encompass two calendar years for both wild and hatchery components of the run (Table 23). The median migration date occurred from April to early May for wild winter steelhead and from early February to late April for subbasin hatchery winter steelhead. Migration to the Powerdale Dam trap was completed, in the second calendar year. by early to late June for the wild run and by late April to early June for the subbasin hatchery run (Table 23). The wild run of winter steelhead migrated into the Hood River subbasin later than the subbasin hatchery run for the 1991-92 through 1994-95 run years but run timing was similar for both wild and subbasin hatchery components of the run returning in the 1995-96 run year. The shift in run timing for the subbasin hatchery component of the run is attributed to the use of the wild Hood River stock of winter steelhead as hatchery broodstock. Previous runs of subbasin hatchery winter steelhead were comprised of adults returning from Big Creek stock hatchery winter steelhead releases in the subbasin. The native Hood River stock has a much later run timing than the Big Creek stock of winter steelhead which is an early run hatchery stock. The 1994-95 run year is the last run year in which adult hatchery winter steelhead are expected to return from.Big Creek stock hatchery releases in the Hood River subbasin.

Harvest, Escapement, and Survival

In the sampling area, sport fishers caught and released an estimated 280 and 29 wild and subbasin hatchery winter steelhead. respectively, and harvested an estimated 410 subbasin hatchery winter steelhead in 1996 (Table 24). Estimates of the number of caught and released stray hatchery winter steelhead are in APPENDIX F. Peak harvest occurred from mid- February 'through mid- May. A preliminary estimate of the exploitation rate indicates that in the sampling area sport fishers harvested around 60% of the subbasin hatchery winter steelhead component of the 1995-96 run year returning to the Hood River subbasin.

Estimates of winter steelhead'escapements to the Powerdale Dam trap ranged from 206-699 wild, 10-284 Big Creek stock hatchery, 6-13 mixed-stock hatchery, 0-271 Hood River stock hatchery, and 5-33 stray hatchery fish for the 1991-92 through 1995-96 run years (Table 25).

Preliminary estimates of post-release survival from smolt-to-adult return to the Powerdale Dam trap indicate that survival may have been fairly low for the Big Creek stock of hatchery winter steelhead (i.e.. around 1.5%; Table 26) when compared with estimates of post-release survival for Deschutes stock hatchery summer steelhead released in the Deschutes River subbasin-(see ADULT SUMMER STEELHEAD, Escapement and Survival). The low numbers of adult winter steelhead returning from the off station release of Big Creek stock hatchery smolts directly into the Hood River subbasin. may be the result of a variety of inter-related factors which negatively impact one or more life history stages. Several factors which may significantly contribute to a low rate of return include: 1) a high in-basin post-release smolt mortality rate associated with the cumulative effects of stress prior to, and shortly after, release, 2) the possible poor homing ability of returning hatchery adults. and 3) any inherent reduction in the genetic fitness of the hatchery stock. 'While the exact cause. or causes, of the low rate of return are unknown, it is believed that the percentage of adult winter steelhead returning from a given brood release will be improved both by developing the hatchery broodstock from the wild component of the winter steelhead run (see Broodstock Collection) and by acclimating hatchery smolts from one to four weeks prior to release (i.e.. a volitional release) in the Hood River subbasin. Acclimation sites were identified in the fall of 1995, developed in early 1996, and were operational in the spring of 1996 to acclimate juvenile Hood River stock hatchery winter steelhead from the 1995 brood. Hatchery winter steelhead from the 1995 brood are expected to first return as l-salt adults in the 1996-97 run year.

Prior to the 1991-92 run year, all wild and hatchery winter steelhead were passed above Powerdale Dam. Beginning with the 1991-92 run year, all stray and Big Creek stock hatchery winter steelhead. caught in the Power-dale Dam trap, were transported downriver and released at the mouth of the Hood River. This program was established to prevent non-indigenous stocks from spawning above Powerdale Dam, in accordance with guidelines established in the ODFW's Wild Fish Policy. Releasing hatchery adults at the mouth of the Hood River has an additional benefit created by recycling returning hatchery adult winter steelhead through the sport fishery located below Powerdale Dam. Stray and Big Creek stock hatchery fish are identified based on fin marks.

Limited numbers of Hood River stock hatchery winter steelhead, from-the 1994-95 run year, were passed above Powerdale Dam. These were the first returns of Hood River stock hatchery winter steelhead that'were passed above Powerdale Dam since the current hatchery program was implemented in the winter of 1991. The HRPP passed adult Hood River stock hatchery winter steelhead above Powerdale Dam, on a defined schedule, beginning with the 1995-96 run year. Numbers passed above Powerdale Dam were regulated in accordance with guidelines established in the Wild Fish Policy for .a Type 1 hatchery program.

Age Composition, Size, and Sex Ratio

Most wild winter steelhead migrate as freshwater age-2 and age-3 smolts, and return mainly as 2- and 3-salt adults (Table 27). Subbasin hatchery winter steelhead migrate as freshwater age-l and age-2 smolts and return mostly as 2- and 3-salt adults (Table 27). Repeat spawners comprised 2.6-8.9% of the wild winter steelhead run (Table 27) and 2-3.8% (i.e.. for the 1991-92 and 1992-93 run years) of the subbasin hatchery winter steelhead run sampled at the Powerdale Dam trap. Only one repeat spawner in the 1995-96 run year had more than one spawning check (Table 28).

Mean fork length of wild adult winter steelhead without a spawning check ranged from 47-55 cm for l-salt adult, 58-76 cm for 2-salt adults. and 74-80 cm for 3-salt adults

(Tables 29 and 30). Mean fork length for subbasin hatchery adult winter steelhead without a spawning check ranged from 46-57 cm for l-salt adults, 62-73 cm for 2-salt adults, and 72-77 cm for 3-salt adults (Tables 29 and 30).

Mean weight of wild adult winter.steelhead without a spawning check ranged from 1.1-1.6 kg for l-salt adults, 2.4-4.6 kg for 2-salt adults, and 3.5-5.4 kg for 3-salt adults (Tables 31 and 32). Mean weight of subbasin hatchery adult winter steelhead without a spawning check ranged from 1.0-1.2 kg for l-salt adults, 2.5-3.0 kg for 2-salt adults, and 3.8-4.7 kg for 3-salt adults (Tables 31 and 32).

Althdugh sex ratio as a- percentage of females varied markedly among age classes, wild adult winter steelhead returned mostly as females (Table 33). Subbasin hatchery adult-winter steelhead mainly returned as males in age category 1/2 and as females in age category 1/3 (Table 33). Both wild and subbasin hatchery repeat spawners returned mainly as females.

Estimates of fecundity for wild winter steelhead was estimated at 2,900 eggs per female for one l-salt adult and ranged from 1,737 to 6,480 eggs per female for 2-salt adults, 2,493 to 6,398 eggs per female for 3-salt adults, and 3.240-4.632 eggs per female for 4-salt adults (Table 34). Estimates of fecundity for subbasin hatchery winter steelhead ranged from 2.025 to 3,878 eggs per female for l-salt adults'(Table 34).

Spatial Distribution

Nineteen unmarked winter steelhead. randomly selected from throughout the 1995-96 run year, were tagged with radio transmitters. Six tagged winter steelhead remained in the mainstem Hood River throughout the sampling period and one tagged adult located in the mainstem, in May, was later found in the mainstem Columbia River (Figures 22-24). Twelve tagged adult winter steelhead were found in the major forks: nine in the EFk Hood River, one in the WFk Hood River, and two in the lower Middle Fork (MFk) Hood River. No radio-tagged adult winter steelhead were detected in Neal Creek during the 1996 sampling period. Radio-tagged adult winter steelhead were detected in Neal Creek in both 1994 and 1995 (Olsen et al. 1995 and Olsen et al. 1996). All adult winter steelhead. radio-tagged in 1996, were classified as wild based on scale analysis.

JACK AND ADULT SPRING CHINOOK SALMON

Migration Timing

Natural spring chinook salmon begin entering the Powerdale Dam trap in early May and subbasin hatchery spring chinook salmon begin entering the trap in late April (Table 35). Median date of migration occurred between the first two weeks of June and the last two weeks of July for the natural run, and between the last two weeks of May and the first two weeks of June for the subbasin hatchery run. Both natural and subbasin hatchery components of the run were completed by late September to early October (Table 35).

Harvest, Escapement, and Survival

In the sampling area, sport fishers harvested an estimated 7 and 48 jack and adult spring chinook salmon, respectively, in 1996. Harvest occurred from early May to late July' (Tables 36 and 37). An estimated 30% of the spring chinook salmon returning to the Hood River subbasin in the 1996 run year were harvested, in the sampling area, by the sport fishery.

Estimates of escapement to the Powerdale Dam trap ranged from 20-99 natural, 37-460 Carson stock hatchery, 3-27 Deschutes stock hatchery, and 1-17 stray hatchery spring chinook salmon for the 1992-96 run years (Table 38).

Estimates indicate that smolt-to-adult survival was'fairly low for the Carson stock hatchery production releases in the Hood River subbasin (Table 39). Smolt-to-adult survival averaged approximately 0.18% back to Powerdale Dam, and approximately 0.26% back to the mouth of the Hood River when adjusted for an estimated 30% exploitation rate. Estimates of post-release survival'ranged from 0.78% to 2.39% and averaged 1.63% back to the mouth of the Deschutes River for the 1979-83 brood releases of slow incubated Pelton ladder releases of yearling Deschutes stock hatchery spring chinook salmon in the Deschutes River subbasin (Lindsay et al. 1989). Not only is post-release survival back to the mouth of the Hood River markedly lower than in the Deschutes River subbasin, but the difference would probably be more profound if survival rates to the Deschutes River were adjusted to account for mortality, and potential for further straying, between the mouth of the Hood and Deschutes river subbasins. Post-release survival back to the Deschutes River subbasin is subject to any losses associated with (1) mainstem Columbia River fisheries located between the mouth of the Hood and Deschutes rivers, (2) the negotiation of one additional mainstem Columbia River dam (i.e.. The Dalles Dam). and (3) increased potential for straying.

The low numbers of jack and adult spring chinook salmon returning from the off station release of hatchery smolts directly into the Hood River subbasin. may be the result of a variety of inter-related factors which negatively impact'one or more life history stages. Several factors which may significantly contribute to a low rate of return include: 1) a high in-basin post-release smolt mortality rate associated with the cumulative effects of stress prior to, and shortly after. release, 2) the possible poor homing ability of returning hatchery adults, and 3) any inherent reduction in the genetic fitness of the hatchery stock. While the exact cause, or causes, of the low rate of'return are unknown, it is believed that the percentage of jack and adult spring chinook salmon returning from a given brood release can be improved by acclimating hatchery smolts from one to four weeks prior to release (i.e., a volitional release) in the Hood River subbasin. Acclimation sites were identified in the fall of 1995, developed in early 1996, and were operational in the spring of 1996 to acclimate juvenile Deschutes stock hatchery spring chinook salmon from the 1994 brood. Hatchery spring chinook salmon from the 1994 brood are first expected to return as jacks in the 1997 run year.

Age Composition, Size. and Sex Ratio

Scale analysis indicates that naturally produced spring chinook salmon migrate as both subyearling and yearling smolts and return as four year old adults (Table 40). The subyearling smolt life history pattern appears to be unique to the natural Hood River run, which was developed from Carson stock hatchery production releases in the Hood River subbasin (see Olsen et al. 1994 and Olsen et al. 1995). What mechanism might cause naturally produced spring chinook salmon to migrate as subyearling smolts in the Hood River subbasin, and how progeny of Deschutes stock hatchery spring chinook salmon will ultimately adapt to the Hood River subbasin. is unknown.

Mean fork length of natural adult spring chinook salmon that migrated as yearling smolts ranged from 72-87 cm for age-4 adults and 79-95 cm for age-5 adults (Tables 41 and 42). Mean fork length for subbasin hatchery produced spring chinook salmon ranged from 52-56 cm for age-3 jacks, 74-83 cm for age-4 adults, and 82-92 cm for age-5 adults (Tables 41 and 42).

Mean weight of natural adult spring chinook salmon that migrated as yearling smolts ranged from 4.6-5.4 kg for age-4 adults and from 6.2-9.3 kg for age-5 adults (Table 43 and 44). Mean weight for subbasin hatchery spring chinook salmon ranged from

1.6-1.9 kg for age-3 jacks, from 4.9-5.3 kg for age-4 adults, and from 6.7-8.5 kg for age-5 adults (Tables 43 and 44).

Sex ratio as a percentage of females varied widely for age-4 and age-5 adult spring chinook salmon (Table 45). Age-4 and older natural and hatchery adults returned mostly as females (Table 45).

JACK AND ADULT FALL CHINOOK SALMON

Migration Timing

Natural fall chinook salmon begin entering the Powerdale Dam trap from early July to early August and stray hatchery fall chinook salmon begin entering the trap in early to late September (Table 46). Median date of migration occurred between the last two weeks of July and the last two weeks of September for the natural run, and between the first two weeks of September and the last two weeks of September for the stray hatchery run. -Both natural and stray hatchery components of, the run were completed by early November (Table 46).

Harvest and Escapement

In the area of Powerdale Dam, sport fishers harvested an estimated 26 unmarked fall chinook salmon in 1996 (Table 47). Harvest occurred from late October to late November. An estimated 62% of the fall chinook salmon returning to the Hood River subbasin in the 1996 run year were harvested, in the sampling area, by the sport fishery.

Estimates of escapement to the Powerdale Dam trap ranged from 6-32 natural and 2-7 stray hatchery fall chinook salmon for the 1992-96 run years (Table 48).

Age Composition, Size, and Sex Ratio

Scale analysis indicates that naturally produced fall chinook salmon primarily migrate as sub-yearling smelts-and return as four and five year old adults (Table 49). Mean fork length of natural fall chinook salmon, that migrated as sub-yearling smolts, ranged from 79-89 cm for age-4 adults and 89-96 cm for age-5 adults (Tables 50 and 51). Mean weight of natural fall chinook salmon that migrated as sub-yearling smolts ranged from 7.0-8.9 kg for age-4 adults and from 9.1-9.5 kg for age-5 adults (Tables 52 and 53).

Sex ratio as a percentage of females varied widely for age-4 and age-5 adult fall chinook salmon (Table 54). Age-4 and older natural adults returned mostly as females (Table 54).

JACK AND ADULT COHO SALMON

Migration Timing

Natural coho salmon begin entering the Powerdale Dam trap as early as the first two weeks of September (Table 55). The median date of migration for natural coho salmon occurred around late September to early October (Table 55). The natural run was completed by late October to early November. The early entry time of natural coho salmon suggests returns may be progeny of hatchery strays (see Olsen et al. 1995). No information is available to test this hypothesis because of the lack of any information on the temporal distribution of migration for the original wild run of coho salmon in the Hood River subbasin.

Escapement

For the 1992-96 run years, estimates of coho salmon escapement ranged from O-24 natural and from 20-79 stray hatchery fish (Table 56).

Age composition, Size, and Sex Ratio

To date, all natural coho salmon escaping to the Powerdale Dam trap have been adults (Table 57). Mean fork length ranged from 56-70 cm for natural adult coho salmon and from 36-40 cm and 58-71 cm for jack and adult stray hatchery coho salmon, respectively (Tables 58 and 59). Mean weight ranged from 1.8-3.9 kg for natural adult coho salmon and from 0.5-0.8 kg and 3.5-3.1 kg for jack and adult stray hatchery coho salmon, respectively (Tables 60 and 61). Sex ratio, as a percentage of females, ranged from 33-100 percent for natural adult coho salmon (Table 62).

Spatial Distribution

Thirteen unmarked coho salmon selected from the 1996 run year were tagged with radio transmitters. Scale analysis identified one of the tagged coho salmon as a naturally produced adult and the rest as hatchery adults, Twelve of the thirteen tagged coho salmon remained in the mainstem Hood River throughout the sampling period (Figures 25 and 26). One moved upriver to RM 5.5 in the month of November, but later moved out of the Hood River and was found in Herman Creek in the month of December (Figures 25 and 26).

HATCHERY PRODUCTION

Broodstock Collection

The current hatchery production program in the Hood River subbasin was implemented beginning in 1990. A description of how the program has evolved into the present day program is provided in Olsen et al. (1994). Olsen et al. (1995), and Olsen et al. (1996).

Numbers of adult winter steelhead collected for hatchery broodstock ranged from 4-54 adults (Table 63). Fifty-four adults were collected from the 1995-96 run year. For the 1991-96 broods, egg take ranged from 11.858-95.043 and egg to smolt survival ranged from 38.8-96.5% (Table 63).

The hatchery program began collecting hatchery broodstock from the Hood River stock of adult hatchery winter steelhead returning in the 1995-96 run year (*see* Olsen et al. 1996). Hatchery winter steelhead are collected randomly from throughout the run and total numbers collected for broodstock is limited to a maximum of 50% of the total hatchery broodstock collected for the hatchery program.

Production Releases

Numbers of hatchery steelhead smolts released into the Hood River subbasin ranged from 70,928 to 99,973 summer steelhead and from 4,595 to 50,896 winter steelhead for the 1987-95 broods (Tables 64 and 65). There were 68,378 summer and 50,896 winter steelhead from the 1995 brood released into the Hood River subbasin in 1996. Numbers of hatchery spring chinook salmon smolts released into the Hood River subbasin ranged from 75.205 to 197,988 smolts for the 1986-91 and 1993-94 broods (Table 66). No spring chinook salmon smolts were released into the Hood River subbasin from the 1992 brood (see Olsen et al. 1995). There were 129,047 spring chinook salmon smolts (i.e.. unadjusted for trapping mortality) released into the Hood River subbasin in 1996 (1994 brood).

All hatchery fish are released into the Hood River subbasin as full term smolts. The' hatchery program is currently being implemented at a reduced level until escapements of wild summer and winter steelhead and natural spring chinook salmon are improved. Target production goals for the current hatchery program in the Hood River subbasin are 60,000 Foster stock summer steelhead; 30.000 Hood River stock winter steelhead: and 125,000 Deschutes stock spring chinook salmon smolts. At full implementation, the HRPP's hatchery production goals are 85,000 Hood River stock summer steelhead; 85.000 Hood River stock winter steelhead; and 250,000 Deschutes stock spring chinook salmon smolts. Production goals for summer and Hood River stock winter steelhead have been exceeded under the current hatchery program. Target production goals for spring chinook salmon have been achieved or exceeded, under the current hatchery program, with the exception of the 1991 and 1992 brood releases (*see* Olsen et al. 1995).

Juvenile hatchery summer and winter steelhead are reared at Oak Springs hatchery. All juvenile hatchery spring chinook salmon production, beginning with the 1993 brood. have been reared at Round Butte Hatchery. Juvenile hatchery spring chinook salmon from the 1994 brood were the first to be finish reared in the newly completed Pelton ladder facility. Juvenile hatchery spring chinook salmon were transferred from Round Butte Hatchery to Pelton ladder on 27 and 28 September 1995.

The winter steelhead and spring chinook salmon components of the Hood River Production Program are being implemented at a reduced level based on the approach outlined in Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs (Undated).

Post-Release Survival

A juvenile migrant trap was operated in the mainstem Hood River (RM 4.5) to estimate numbers of downstream migrant hatchery smolts leaving the Hood River subbasin. An estimated 28.277 summer and 32,914 winter steelhead smolts passed the mainstem migrant trap during the sampling period (Table 67). Estimates represent 41% and 73% of the total hatchery summer and winter steelhead production releases, respectively. Numbers of hatchery winter steelhead smolts migrating past the mainstem migranttrap. as a percentage of the total production release, was substantially higher than in the two previous years for which estimates are available (Table 67). This was the first year in which hatchery winter steelhead were acclimated prior to release and acclimation may have been a factor which caused the increase.

The recapture rate on smolts that were both marked and released at the mainstem migrant trap was consistently lower for both hatchery summer and winter steelhead than for wild rb-st. A similar relation in the recapture rate between wild and hatchery smolts was also observed in both 1994 and 1995 (Appendix Table B-1). The lower recapture rate for hatchery summer and winter steelhead smolts is believed to be caused by a combination of 1) a significantly higher rate of handling mortality on hatchery fish and 2) altered migratory behavior caused by handling stress. This assumption is based on visual observation of the condition of downstream migrant hatchery smolts. Hatchery summer steelhead smolts sampled at the mainstem migrant trap generally appeared to be in much poorer condition than downstream migrant wild rb-st and both hatchery summer and winter steelhead smolts were generally more susceptible to handling stress (i.e.,, a higher rate of handling mortality). Both problems were particularly evident with the hatchery summer steelhead production releases. In particular, downstream migrant hatchery summer steelhead generally exhibited considerable descaling and many were observed with deformed opercles. The deformed opercle was unique to the hatchery summer steelhead production release and has been observed in all three years we have operated the mainstem migrant trap. A combination of both poor condition, as well as the stress associated with the hauling of hatchery fish for off station release into the Hood River subbasin. is believed to have put hatchery smolts at or near their level of tolerance for stress, Preliminary data indicates that acclimation may help to minimize stress related problems but, in general, the additional stress of trapping and handling at the migrant traps is believed to have increased either 1) the potential handling mortality or 2) the possibility of modifying niigration behavior.

Any artificial reduction in the mark:recapture ratio would have the net effect of inflating the population estimate. To minimize the potential for biasing the population estimates for hatchery steelhead, the mark:recapture ratio for downstream migrant wild rb-st was used as the expansion factor for estimating numbers in each hatchery production group. The mark:recapture ratio for downstream migrant wild rb-st was used as the expansion factor based on the assumption that it more accurately reflects trapping efficiency at the mainstem migrant trap. There was also no reason to assume that either hatchery production group should have a lower rate of recapture than the wild rb-st based on the fact that all three groups migrated past the mainstem migrant trap during the same time period. Using the mark:recapture ratio for downstream migrant wild rb-st to estimate numbers of downstream migrant hatchery summer and winter steelhead at the mainstem migrant trap also represents a more conservative approach for estimating hatchery production leaving the Hood River subbasin..

Size and Weight

Mean length, weight, and condition factor were estimated for one of two size groups of Hood River stock hatchery winter steelhead reared at Oak Springs Hatchery (OSH). Hatchery winter steelhead production at OSH was graded into the two size groups prior to tagging in late October. The two groups were classified as medium- and large-sized fish and were comparable to medium- and large-sized groups sampled from previous broods. No juvenile hatchery winter steelhead from the 1995 brood were grouped into a size category comparable to the small-sized group sampled from the 1993 brood. Juveniles in this small-sized group were all progeny of the last hatchery production spawning on 9 June 1993 (Olsen et al. 1995). Juveniles from the last hatchery production spawning in 1993 were markedly smaller than juveniles in the rest of the hatchery production group so they were held separately in a small circular tank and categorized as the small-sized group. No similar situation occurred with the 1995 brood. The one size group sampled from the 1995 brood will be classified as the large-sized group throughout the rest of-this report and is comparable with the large-sized group sampled from previous broods. No sample was collected from the medium-sized group.

Medium- and large-sized groups of hatchery winter steelhead were reared in separate raceways at OSH. Hatchery production was graded into the two size groups to facilitate coded-wire tagging and to provide hatchery personnel the ability to implement a modified feeding schedule targeting the smaller juveniles in the production group. The modified feeding schedule was designed to accelerate the growth of smaller juveniles so that the entire production group would be more uniformly smolt-sized upon release in the subbasin.

Mean fork length was 196 mm for the large-sized group (Table 68). Estimates of mean fork length for the large-sized group from the 1995 brood, when compared with the corresponding size group from previous broods, was less-than the estimate for-the 1993 brood and was similar to the estimate for the 1994 brood.

Mean weight was 90 gm and mean condition factor was 1.2 for the large-sized group (Table 68). Mean condition factor for the 1995 brood large-sized group of hatchery winter steelhead sampled at OSH, prior to release, was higher than for downstream migrant wild rainbow-steelhead sampled at the mainstem migrant trap in 1996 (see JUVENILE RAINBOW-STEELHEAD. Size and Weight). Estimates of mean condition factor for-freshwater age-l through age-4 migrant wild rainbow-steelhead ranged from 0.89 to 0.98 (Table 7). Mean condition factor for hatchery winter steelhead sampled at the mainstem migrant trap was 0.96 (Table 69). This estimate falls within the range of mean estimates observed for downstream migrant wild rainbow-steelhead. Length x weight regressions for the large-sized group of hatchery winter steelhead is presented in figure 27.

SUMMARY

This report summarizes the life history and production data collected in the Hood River subbasin for FY 96. Included is a summary of jack and adult life'history data collected at the Powerdale Dam trap on five complete run years of winter steelhead. spring and fall chinook salmon, and coho salmon, and on four complete run years of summer steelhead. Also included are summaries of 1) the spatial distribution of radio-tagged adult summer and winter steelhead and coho salmon: 2) life history and production data on rearing populations of resident and anadromous salmonids: 3) the hatchery winter steelhead broodstock collection program: 4) hatchery production releases in the Hood River subbasin: and 5) the number of outmigrant wild rainbow-steelhead and hatchery surnmer'and winter steelhead smolts. Data will be used as baseline information for evaluating the HRPP and any impact it may have on indigenous populations of resident and anadromous salmonids. Baseline information on indigenous populations of resident and anadromous salmonids will continue to be collected for several years prior to full implementation of the Hood River Production Program.

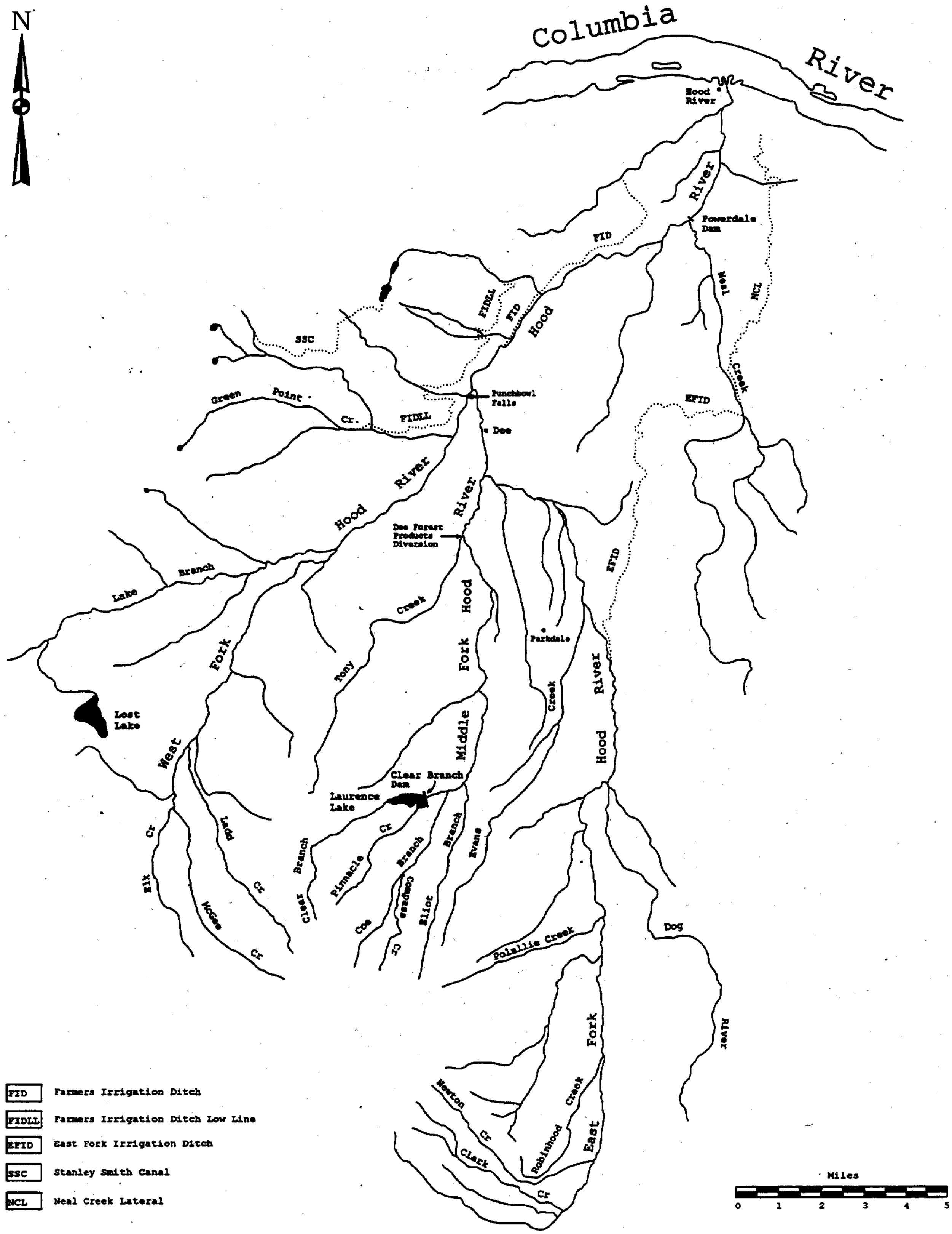

Figure 1. Map of the Hood River subbasin.

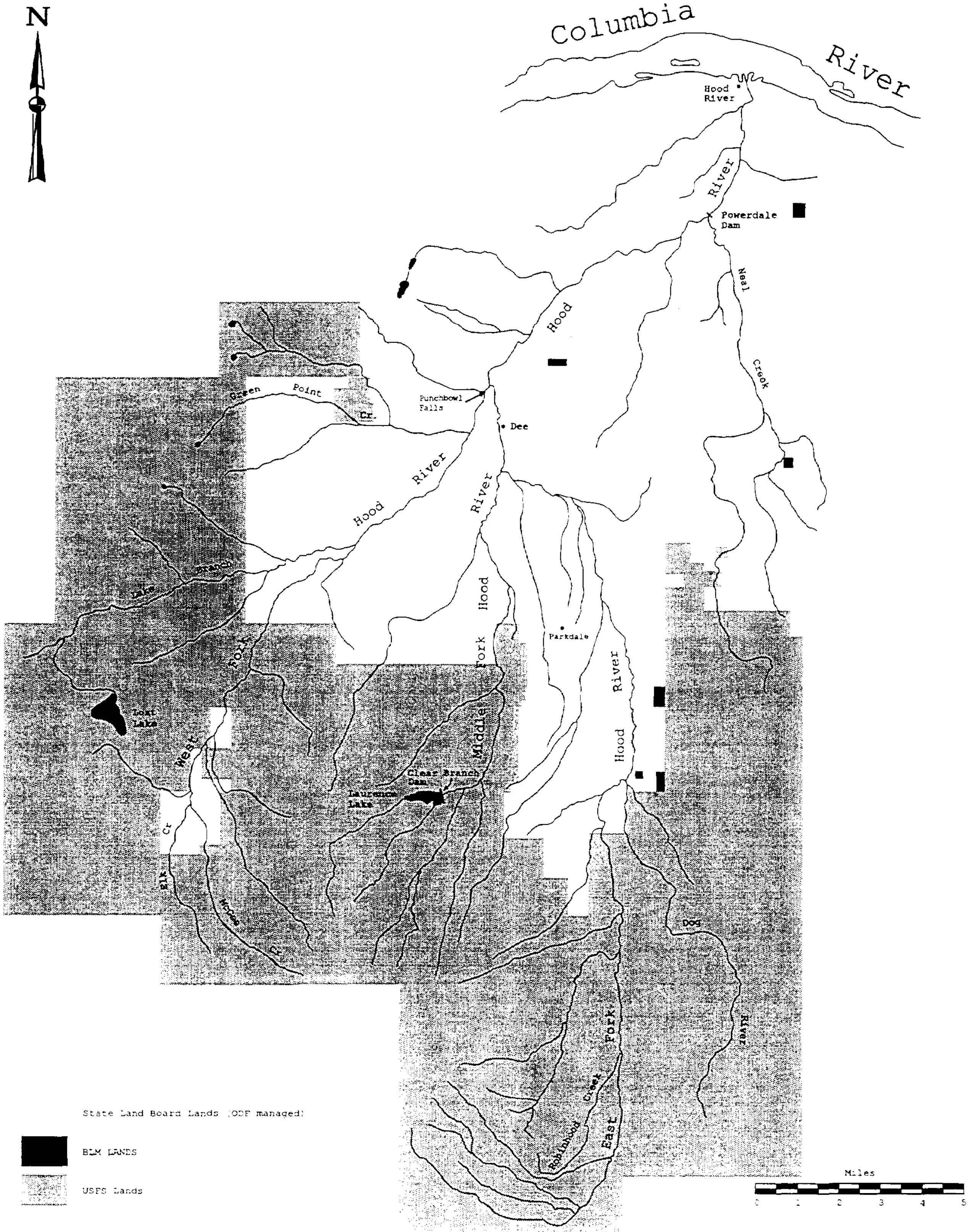

Figure 2. Location of public lands in the Hood River subbasin

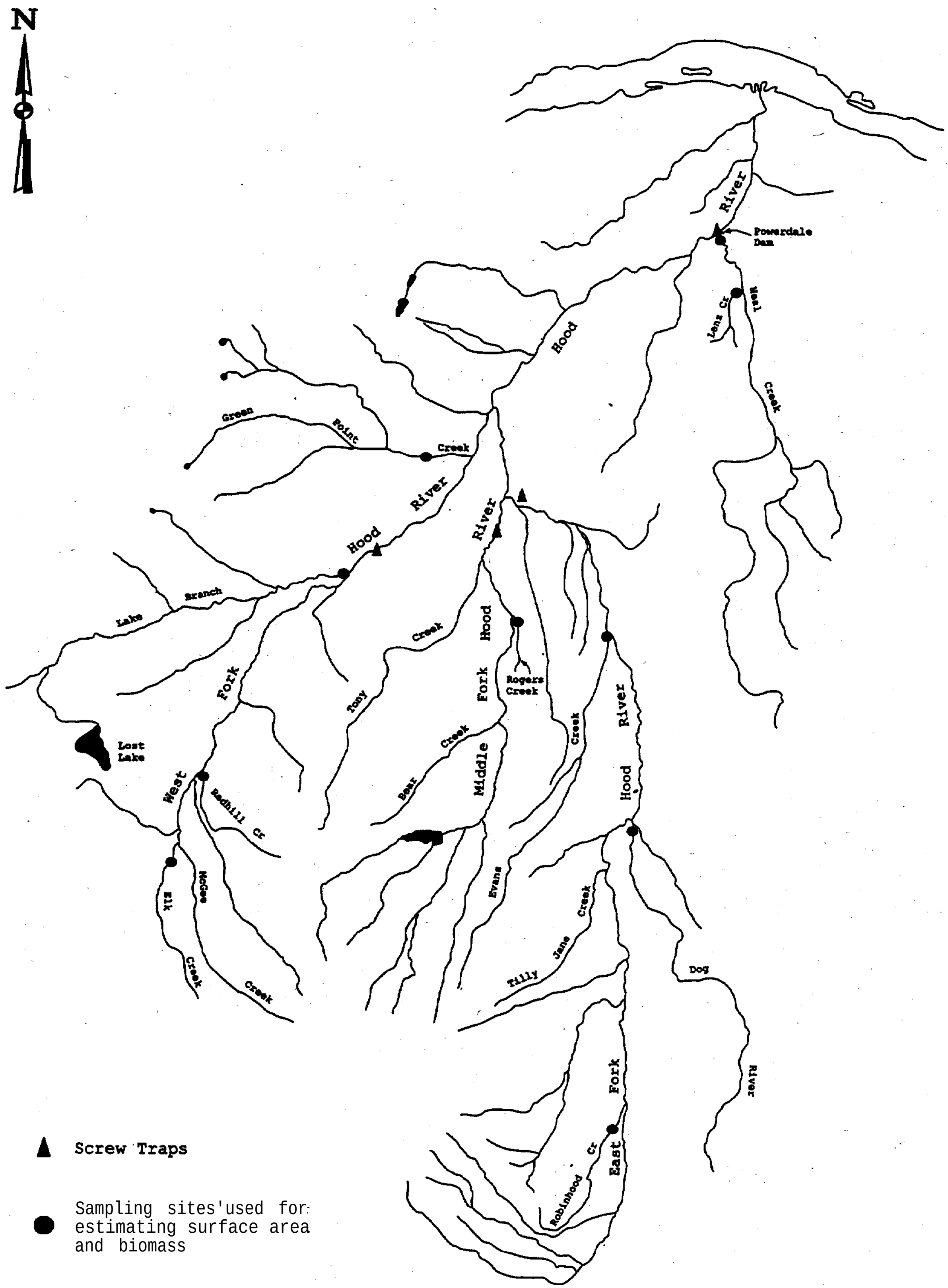

Figure 3. Location of sampling sites in the Hood River subbasin.

Table 2. Estimates of density (numbers) and biomass (gms) in relation to surface area (m^2) and volume (m^3) for rb-st sampled at selected sites in the Hood River subbasin by location, area, and year. (Estimates for hatchery produced steelhead are in parentheses. Sampling dates, reach lengths, and removal numbers for each pass are presented in APPENDIX A and in Olsen et al. 1996. Also included in APPENDIX A are the qualifiers associated with population estimates made in 1996.)

Location, area, year	RM	Fish/1000m² <85mm	Fish/1000m² ≥85mm	Grams/100m²	Fish/1000m³ <85mm	Fish/1000m³ ≥85mm	Grams/100m³
Mainstem,							
Neal Cr.							
19%	0.0	38	10	40	173	45	182
19%	0.0	120	36	141	714	217	846
1994	1.5	20	68(9)	246(117)	71	245(31)	888(421)
19%	1.5	32	46	182	128	184	730
1994	5.0	2%	122(7)	282(--)	1,968	809(45)	1,869(--)
19%	5.0	354	37	197	2,352	245	1,306
Lenz Cr.							
1994	0.5	0.	7	23	0	37	121
19%	0.5	0	0	0	0	0	0
19%	0.5	0	6	44	0	39	287
Nest Fork,							
Greenpoint Cr.							
1994	1.0	346	285	744	2,913	2,401	6,271
1995	1.0	172	134	424	1,305	1,014	3,208
19%	1.0	110	1%	598	665	1,182	3,608
Lake Branch,							
1994	0.2	397	143(1)	431(17)	1,915	688(6)	2,076(80)
19%	0.2	471	56(3)	258(29)	1,980	233(11)	1,079(120)
19%	0.2	103	36	164	375	132	599
1994	4.0	23	99	418	137	592	2,498
1995	4.0	34	86	177	170	438	897
1994	7.0	31	37	84	343	411	938
1995	7.0	62	125	345	404	813	2,246
Red Hill Cr.							
1996	0.1	232	38	171	2,096	346	1,552
1994	1.0	33	73	261	466	1,027	3,676
19%	1.0	10	90	221	137	1,229	3,016
McGee Cr.							
1994	0.5	50	79	155	428	673	1,320
1995	0.5	17	46	171	107	300	1,115
Elk Cr.							
1994	0.5	46	59	207	508	657	2,302
1995	0.5	134	83	202	1,160	720	1,762
1996	0.5	248	119	320	2,649	1,275	3,425
Middle Fork,							
MFk Hood R.							
1994	4.5	45	22	79	322	160	574
Tony Cr.							
1994	1.0	17	54	115	163	528	1,123
1995	1.0	90	12	51	783	108	454
Rogers Cr.							
1996	0.2	3	63	329	13	241	1,261
Bear Cr.							
1994	0.6	0	0	0	0	0	0
1995	0.6	0	0	0	0	0	0

Table 2. Continued.

Location. area. year	RM	Fish/1000m² <85mm	Fish/1000m² ≥85mm	Grams/100m²	Fish/1000m³ <85mm	Fish/1000m³ ≥85mm	Grams/100m³
East Fork, (cont.)							
EFk Hood R.							
1994	0.5	80	89(4)	338(43)	407	453(19)	1.720(221)
1995	0.5	44	45(1)	109(15)	124	128(3)	311(44)
1994	5.5	198	46(12)	167(47)	1.623	376(97)	1.365088)
1995	5.5	100	21(10)	82(55)	381	81(39)	314(211)
1994	20.2	0	2	11	0	10	53
1995	20.2	0	0	0	0	0	0
Evans Creek,							
1996	0.1	206	72	231	1.601	559	1.791
Dog River.							
1994	0.3	0	0	0	0	0	0
1995	0.3	28	9	31	353	110	376
1996	0.7	167	16	82	1.373	139	708
Tilly Jane Cr.							
1994	0.1	0	0	0	0	0	0
1995	0.1	0	0	0	0	0	0
Robinhood Cr.							
1994	1.0	0	0	0	0	0	0
1995	1.0	0	0	0	0	0	0

Table 3. Estimated number of wild downstream migrant rainbow-steelhead to a migrant trap located at RM 4.5 in-the mainstem Hood River by age category. (Percent of total migrants is in parentheses. Population estimators and sampling period are in APPENDIX B.)

Year[b]	Estimated number[a] of migrants	95% C.I.	Estimated number by age catworv Age 0	Age 1	Age 2	Age 3	Age 4
1994	9.916	4.473 - 15,359	250 (2.5)	2.333 (23.5)	6.375 (64.3)	958 (9.7)	0 (0)
1995	8.075	641 - 15.508	--	1.799 (22.3)	4,918 (60.9)	1.358 (16.8)	0 (0)
1996	8,742	6.179 - 11.305	--	1.050 (12.0)	6.164 (70.5)	1.506 (17.2)	22 (0.3)

[a] Estimates do not include juvenile steelhead migrants from Neal Creek. a major mainstem Hood River tributary draining into a side channel opposite the mainstem migrant trap.

[b] Beginning in 1995. estimates are for'migrants ≥150 mm fork length. There were no age 0 juveniles in this size category. Prior to 1995. estimates include all size. and age, categories of wild downstream migrant rb-st trapped at the mainstem migrant trap.

Table 4. Freshwater age structure (percent) of wild adult Sumner and winter steelhead sampled at the Powerdale Dam trap by race and run year. (Estimates do not include repeat spawners.)

Race, run year	N	Freshwater age: Age 1	Age 2	Age 3	Age 4
Sumner,					
1992-93	474	1.1	81.0	17.7	0.2
1993-94	234	1.3	74.8	23.9	0
1994-95	205	0	58.5	41.5	0
1995-96	129	0	89.1	10.9	0
Winter,					
1991-92	647	1.1	78.8	19.9	0.2
1992-93	380	2.1	87.9	10.0	0
1993-94	393	2.0	92.4	5.6	0
1994-95	188	1.1	90.4	8.5	0
1995-96	271	5.2	84.1	10.7	0

Table 5. Estimated number of wild steelhead smolts migrating fran the Hood River subbasin. by age category. (Percent of total migrants is in parentheses.)

Year	Estimated number of smolts	Freshwater age: Age 1	Age 2	Age 3	Age 4
1994	7.335	1.166 (15.9)	5.208 (71.0)	961 (13.1)	0 (0)
1995	6.313	1,138 (18.0)	4.037 (64.0)	1.138 (18.0)	0 (0)
1996	6.779	799 (11.8)	4,726 (69.7)	1.232 (18.2)	22 (0.3)

Table 6. Estimates of mean fork length (mm) and condition factor for wild rainbow-steelhead sampled at selected sites in the Hood River subbasin. by location and area. (Sampling dates are In APPENDIXA.)

Location. area	River mile	Year	Fork length (mm) N	Mean	Range	95% C.I.	Condition factor[a] N	Mean	Range	95% C.I.
Mainstem.										
Neal Cr	0	i995	21	78	46-148	±14.6	21	1.20	1.06-1.43	± 0.05
Neal Cr	0	1996	66	83	54-169	± 5.8	66	1.22	1.00-1.47	± 0.03
Neal Cr	1.5	1994	27	127	67-203	±16.0	27	1.09	0.96-1.24	± 0.03
Neal Cr	1.5	1995	23	107	54-182	±16.9	23	1.35	1.04-1.88	± 0.08
Neal Cr	5.0	1994	105	74	42-165	± 6.0	104	1.14	0.83-2.32	± 0.04
Neal Cr	5.0	1595	121	64	38-160	± 4.8	121	1.11	0.72-1.48	± 0.02
Lenz Cr	0.5	1994	1	144	144	--	1	1.10	1.10	--
Lenz Cr	0.5	1996	1	180	180	--	1	1.26	1.26	--
West Fork.										
Greenpoint Cr	1.0	1994	212	98	44-215	± 4.4	212	1.09	0.70-1.92	± 0.01
Greenpoint Cr	1.0	1995	207	96	40-192	± 4.0	203	1.13	0.90-1.88	± 0.02
Greenpoint Cr	1.0	1996	181	109	58-206	± 5.1	178	1.19	0.88-1.85	± 0.02
Lake Branch	0.2	1994	254	80	46-242	± 3.4	253	1.05	0.61-1.69	± 0.01
Lake Branch	0.2	1995	389	69	39-197	± 2.0	220	1.19	0.78-1.84	± 0.02
Lake Branch	0.2	1996	104	a7	36-201	± 7.0	103	1.10	0.60-1.55	± 0.03
Lake Branch	4.0	1994	57	140	70-285	±10.6	56	1.06	0.74-1.57	± 0.03
Lake Branch	4.0	1995	82	100	59-192	± 6.5	81	1.16	0.92-1.43	± 0.03
Lake Branch	7.0	1994	18	89	38-209	62.5	18	1.01	0.77-1.25	± 0.06
Lake Branch	7.0	1995	69	101	30-236	±11.5	69	1.08	0.63-1.85	± 0.04
Red Hill Cr	0.1	1996	70	70	40-153	± 6.6	70	1.21	0.74-1.64	± 0.03
Red Hill Cr	1.0	1994	15	124	81-205	61.3	15	1.14	0.98-1.27	± 0.05
Red Hill Cr	1.0	1995	20	118	35-188	±15.3	20	1.13	0.97-1.40	± 0.05
McGee Cr	0.5	1994	48	91	51-197	± 8.9	48	1.14	0.97-1.42	± 0.03
McGee Cr	0.5	1995	31	120	31-206	d6.4	31	1.15	0.97-1.49	± 0.04
Elk Cr	0.5	1994	27	85	35-228	±20.5	27	1.06	0.51-2.08	± 0.10
Elk Cr	0.5	1995	86	74	30-174	± 9.6	62	1.05	0.67-1.34	± 0.04
Elk Cr	0.5	1996	117	74	41-203	± 6.6	109	1.18	0.90-1.92	± 0.03
Middle Fork.										
MFk Hood R	4.5	1994	25	92	58-176	±15.5	25	1.19	0.96-1.59	± 0.06,
Rogers Cr	0.2	1996	17	149	52-225	±20.5	17	1.27	1.06-1.64	± 0.07
Tony Cr	1.0	1994	19	99	41-148	±19.0	19	1.06	0.83-1.45	± 0.07
Tony Cr	1.0	1995	33	60	36-182	±10.1	33	1.23	0.88-2.79	± 0.11
East Fork,										
EFk Hood R	0.5	1994	97	103	45-200	± 8.6	97	1.16	0.75-1.65	± 0.02
EFk Hood R	0.5	1995	66	94	54-186	± 6.5	66	1.19	0.77-1.52	± 0.03
EFk Hood R	5.5	1994	72	70	52-162	± 6.7	71	1.04	0.48-1.45	± 0.04
EFk Hood R	5.5	1995	79	68	30-161	± 6.2	79	1.16	0.37-1.42	± 0.03
EFk Hood R	20.2	1994	1	167	167	--	1	1.14	1.14	--
Evans Cr	0.1	1996	77	80	40-186	± 6.2	77	1.13	0.77-1.69	± 0.03
Dog River	0.3	1995	11	69	35-143	±29.6	11	1.06	0.86-1.32	± 0.07
Dog River	0.7	1996	40	58	26-196	t14.7	40	1.10	0.57-1.50	± 0.06

[a] Condition factor was estimated as $(100*weight(gms)/length(cm)^3)$.

Table 7. Estimates of mean fork length (FL; mm), weight (gm), and condition factor (CF) for wild downstream migrant rainbow-steelhead sampled at a juvenile migrant trap located at RM 4.5 in the mainstem Hood River, by age category and for the sample mean. (Sampling periods are in APPENDIX B.)

Statistic, age, year	N	Mean	Range	95% C.I.
FL (mm),				
Age 0,				
1994	6	78.3	67 - 107	± 15.6
1995	1	74	74	--
19%	0	—	—	
Age 1.				
1994	56	165.4	120 - 200	± 4.3
1995	56	171.2	77 - 216	± 6.2
1996	48	176.0	84 - 264	± 8.1
Age 2.				
1994	153	180.3	129 - 221	± 2.4
1995	135	180.3	144 - 218	± 2.7
1996	274	177.3	147 - 224	± 1.9
Age 3.				
1994	23	196.0	168 - 214	± 5.1
1995	37	181.f	153 - 202	± 4.4
19%	67	180.9	149 - 246	± 4.2
Age 4.				
1994	0	--	--	
1995	0	--	--	--
1996	1	189	189	--
Total,[a]				
1994	420	176.3	67 - 221	± 2.0
1995	268	163.6	27 - 218	± 5.5
1996	623	176.9	29 - 264	± 1.6
Weight (gms)				
Age 0.				
1994	6	6.0	3.2 - 13.1	± 3.8
1995	1	4.0	4.0	--
1996	0	—	—	--
Age 1.				
1994	44	43.8	21.1 - 69.8	± 3.3
19%	54	55.4	4.6 - 96.9	± 5.1
19%	42	53.1	7.2 - 103.9	± 6.1
Age 2.				
1994	114	60.4	26.1 - 91.8	± 2.6
1995	133	58.2	27.3 - 117.6	± 2.8
19%	242	53.7	26.3 - 115.2	± 2.0
Age 3.				
1994	17	76.9	46.7 - 100.9	± 7.9
1995	35	56.7	29.6 - 82.7	± 5.0
19%	59	55.2	28.8 - 116.2	± 4.0

Table 7. Continued.

Statistic, age. year	N	Mean	Range	95% C.I.
Weight (gms), (cont.)				
Age 4.				
1994	0	--	--	
1995	0	--	--	--
1996	1	60.0	60.0	--
Total.[a]				
1994	283	56.3	3.2 - 100.9	± 2.1
1995	251	52.2	0.1 - 117.6	± 2.8
1996	540	54.2	0.9 - 126.4	± 1.4
CF.[b]				
Age 0.				
1994	6	1.17	1.06 - 1.42	± 0.14
1995	1	0.99	0.99	--
1996	0	--	--	
Age 1.				
1994	44	0.96	0.75 - 1.22	± 0.03
1995	54	1.05	0.83 - 1.30	± 0.03
1996	42	0.98	0.84 - 1.21	± 0.03
Age 2.				
1994	114	1.02	0.83 - 1.46	± 0.02
1995	133	0.97	0.78 - 1.24	± 0.01
1996	242	0.94	0.70 - 1.21	± 0.01
Age 3.				
1994	17	1.00	0.82 - 1.27	± 0.06
1995	35	0.93	0.81 - 1.17	± 0.03
1996	59	0.92	0.73 - 1.13	± 0.02
Age 4.				
1994	0	--	--	
1995	0	--	--	--
1996	1	0.89	0.89	--
Total.[a]				
1994	283	1.01	0.75 - 1.46	± 0.01
1995	251	0.98	0.34 - 1.65	± 0.02
19%	540	0.94	0.69 - 1.31	± 0.01

[a] Includes juvenile migrants in which age was unknown.
[b] Condition factor was estimated as $(100 \cdot weight(gms)/length(cm)^3)$.

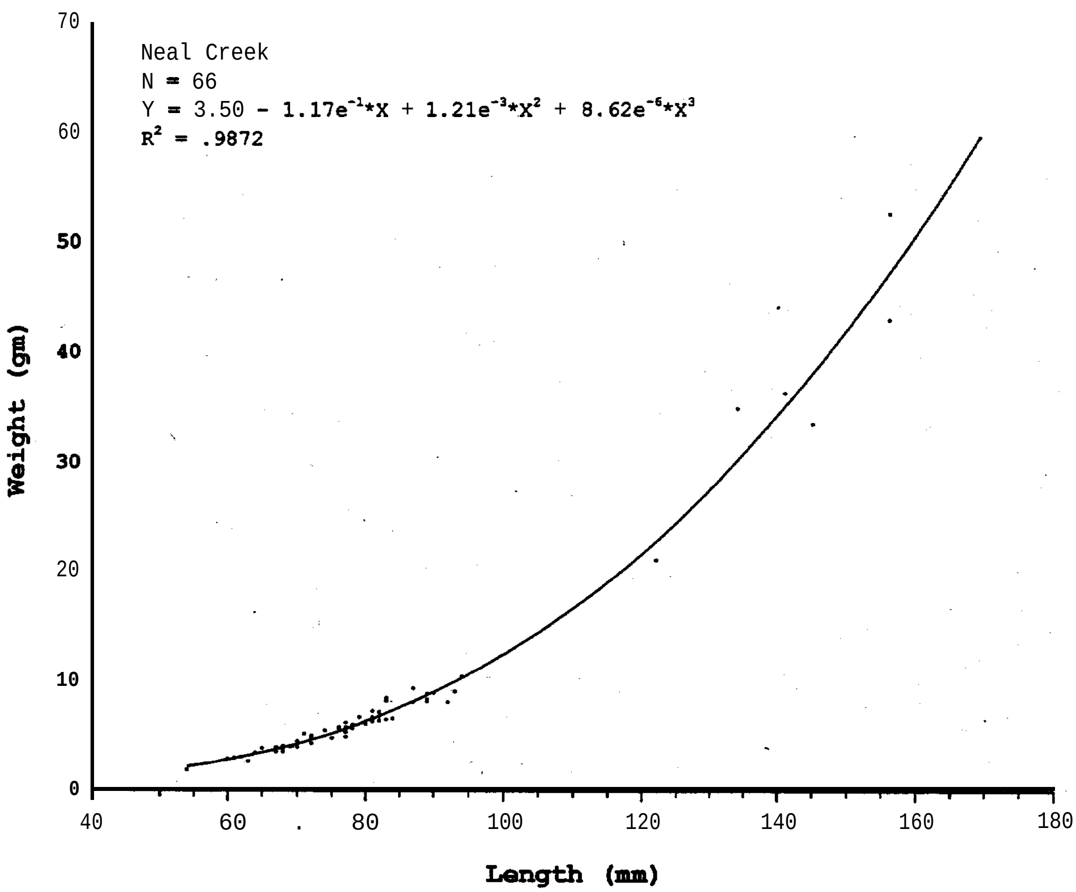

Figure 4. Length x weight regression of wild rainbow-steelhead sampled at the mouth of Neal Creek, 1996.

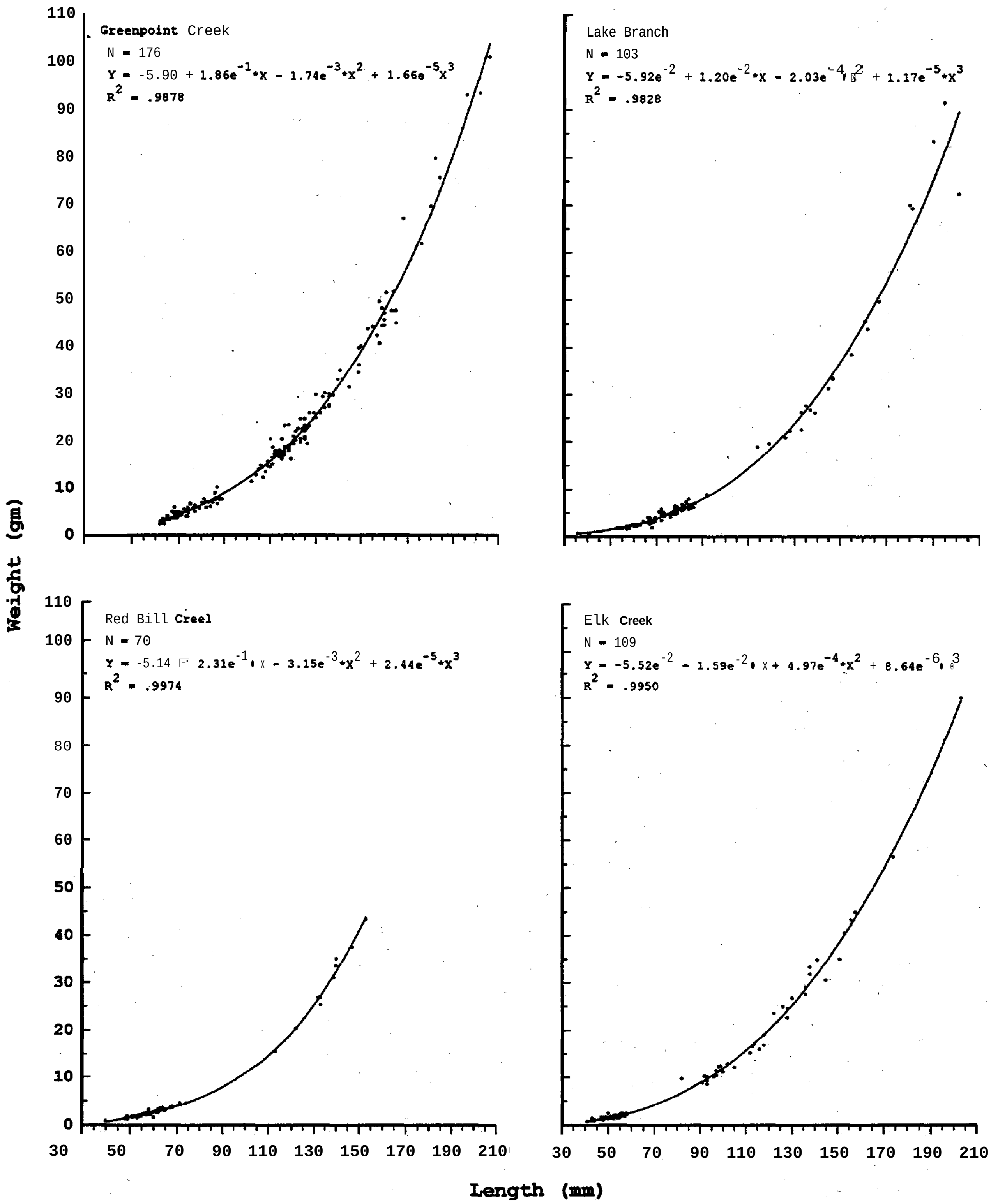

Figure 5. Length x weight regression of wild rainbow-steelhead sampled at selected sites in Greenpoint. Red Hill, and Elk creeks and in Lake Branch, 1996.

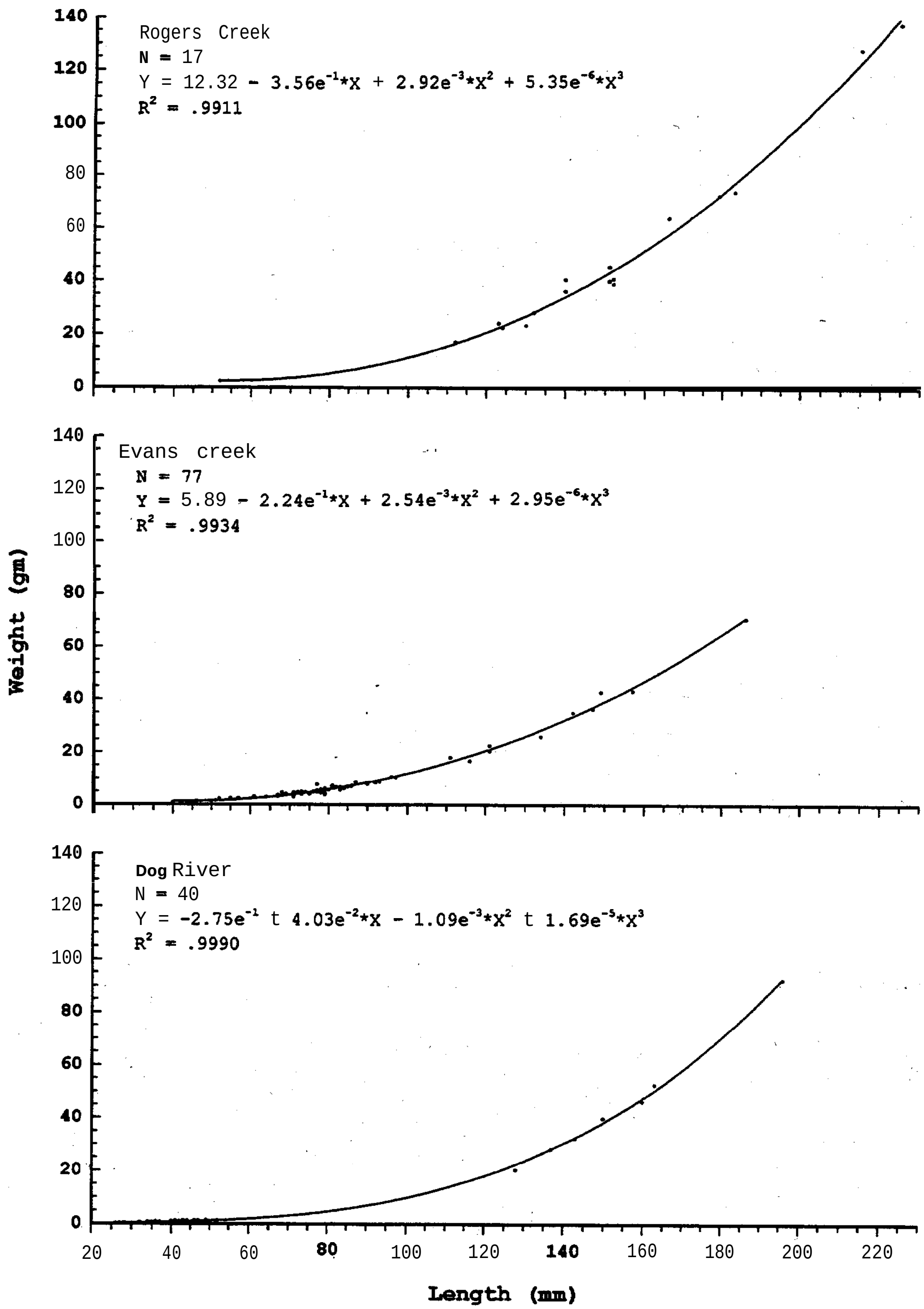

Figure 6. Length x weight regression of wild rainbow-steelhead sampled at selected sites in Rogers and Evans creeks and in Dog River, 1996.

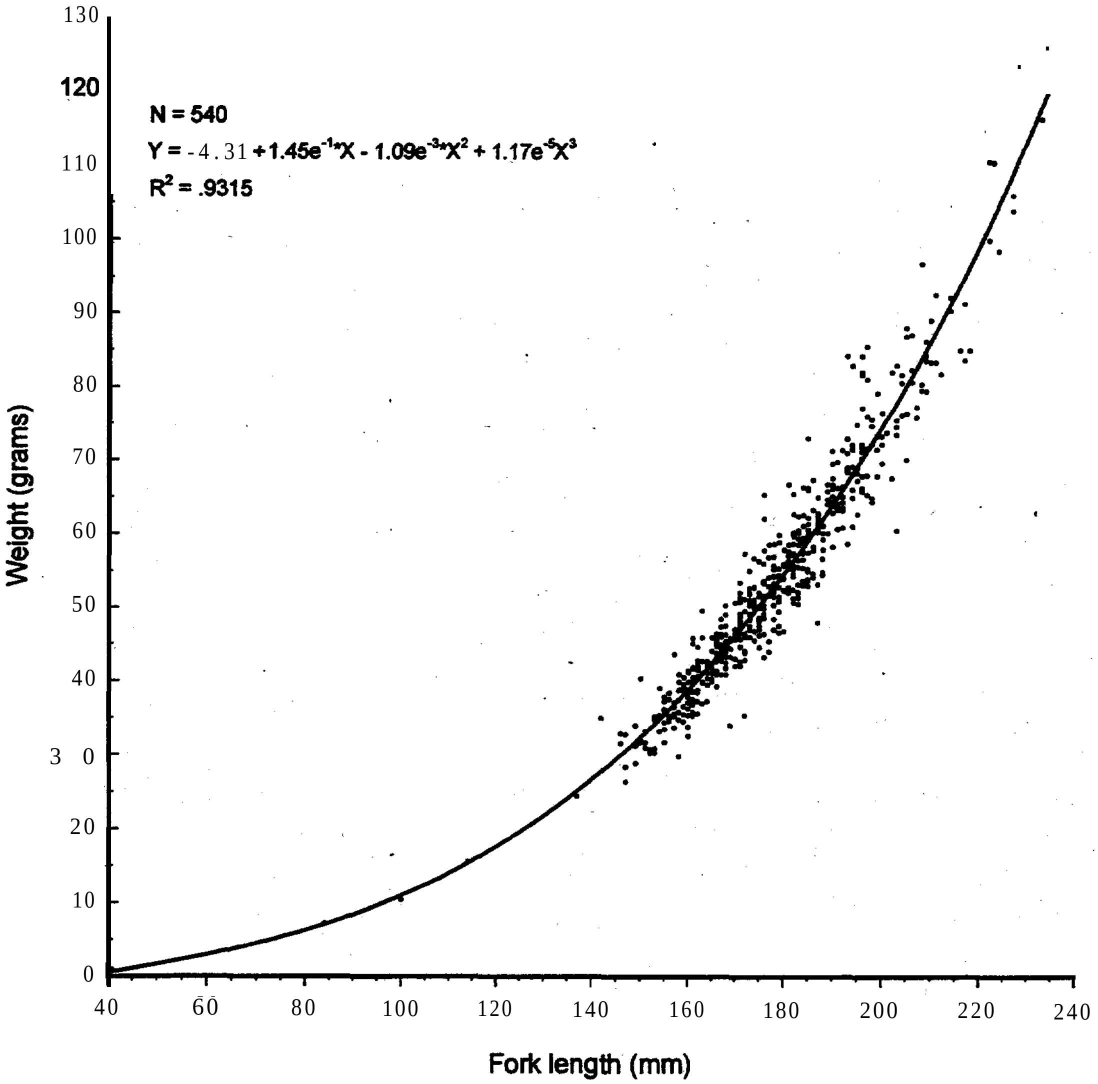

Figure 7. Length x weight regression of downstream migrant wild rainbow-steelhead sampled from 3 April through 31 July 1996 at a juvenile migrant trap located at RM 4.5 in the mainstem Hood River.

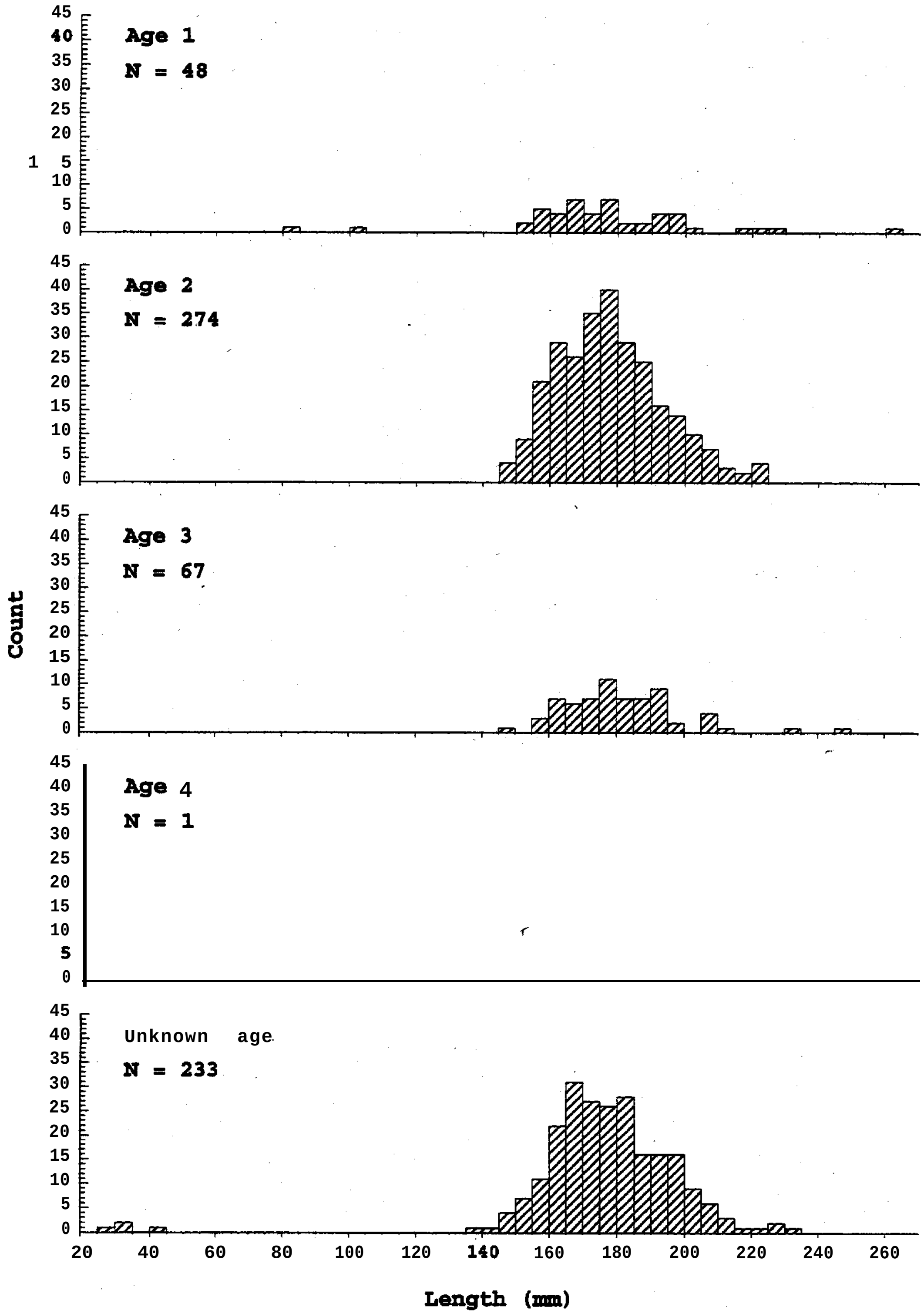

Figure 8. Length frequency histogram of downstream migrant wild rainbow-steelhead, sampled from 3 April through 31 July 1996 at a juvenile migrant trap located at RM 4.5 in the mainstem Hood River, by age category.

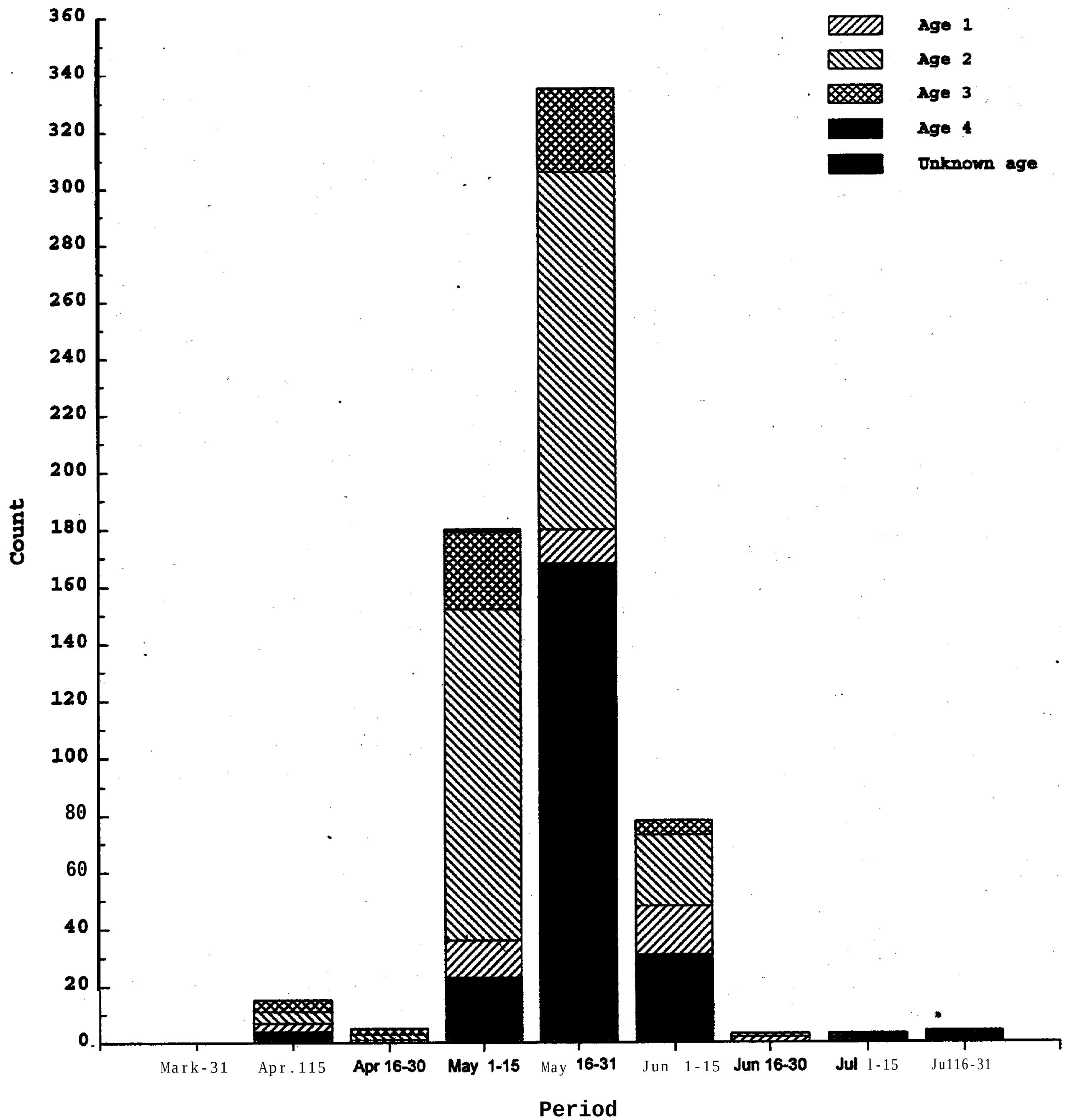

Figure 9. Temporal distribution of downstream migrant wild rainbow-steelhead sampled from 3 April through 31 July 1996 at a juvenile migrant trap located at RM 4.5 in the mainstem Hood River. Estimates are not adjusted for trap efficiency.

Table 8. Estimates of density (numbers) and biomass (gms) in relation to surface area (m^2) and volume (m^3) for wild cutthroat trout sampled at selected sites in the Hood River subbasin by location. area, and year. (Sampling dates. reach lengths, and removal numbers for each pass are presented in APPENDIX A and in Olsen et al. 1996. Also included in APPENDIXA are the qualifiers associated with population estimates made in 1996.)

Location, area. year	RN	Fish/1000m^2 <85mm	Fish/1000m^2 ≥85mm	Grams/100m^2	Fish/1000m^3 <85mm	Fish/1000m^3 ≥85mm	Grams/100m^3
Mainstem.							
heal Cr.							
1995	1.5	0	3	8	0	13	33
1994	5.0	0	3	14	0	22	104
1995	5.0	40	18	60	263	117	390
Middle Fork,							
Rogers Cr.							
1996	0.2	0	3	29	0	13	126
Tony Cr.							
1994	1.0	46	85	163	452	825	1.581
1995	1.0	50	134	400	432	1.169	3.485
Bear Cr							
1994	0.6	55	223	377	483	1.966	3.321
1995	0.6	122	237	501	1.038	2.014	4.261
East Fork.							
EFk Hood R.							
1994	0.5	8	1	5	41	6	28
19%	0.5	10	1	11	30	3	32
1994	20.2	0	4	14	0	20	72
Evans Cr.							
19%	0.1	4	14	60	20	111	479
Dog River.							
1994	0.3	30	45	119	615	922	2.442
1995	0.3	6	55	185	73	702	2.354
1996	0.7	6	66	133	52	545	1.096
Tilly Jane Cr.							
1994	0.1	38	113	172	376	1.113	1.695
1995	0.1	211	105	272	2.774	1.380	3.572
Robinhood Cr.							
1994	1.0	155	238	637	866	1.331	3.564
1995	1.0	283	206	582	1.468	1.070	3.023
1996	1.0	385	225	604	2.769	1.616	4.340

Table 9. **Estimates** of mean fork length **(mm)** and condition factor for wild **cutthroat trout sampled** at selected sites in the Hood **River subbasin.** by location **and** area. **(Sampling** dates are' in APPWIX **A.)**

Location, area	River mile	Year	Fork length (mm) N	Mean	Range	95% C.I.	Condition factor[a] N	Mean	Range	95% C.I.
Mainstem.										
Neal Cr	1.5	1995	1	133	133-133	--	1	1.08	1.08-1.08	--
Neal Cr	5.0	1994	1	165	165	--	1	1.05	1.05	--
Neal Cr	5.0	1995	13	85	53-159	±18.5	13	1.18	1.05-1.40	± 0.07
Middle Fork.										
Rogers Cr	0.2	19%	1	210	210	--	1	1.05	1.05	--
Tony Cr	1.0	1994	24	88	48-178	±15.3	24	1.08	0.87-1.28	± 0.05
Tony Cr	1.0	19%	56	110	51-205	±11.2	56	1.13	0.75-1.51	± 0.04
Bear Cr	0.6	1994	76	104	58-190	± 6.1	74	1.00	0.55-1.42	± 0.03
Bear Cr	0.6	1995	112	104	34-170	± 5.6	112	1.06	0.77-1.87	± 0.03
East Fork.										
EFk Hood R	0.5	1994	4	84	68-114	--	4	1.09	1.03-1.18	± 0.10
EFk Hood R	0.5	1995	9	84	62-191	±31.3	9	1.09	0.96-1.22	± 0.07
EFk Hood R	20.2	1994	2	152	134-171	--	2	1.01	0.90-1.11	--
Evans Cr	0.1	19%	4	158	131-200	60.0	4	0.99	0.89-1.07	± 0.12
Oog River	0.3	1994	30	102	42-203	±12.9	30	1.15	0.92-2.19	± 0.08
Dog River	0.3	1995	21	129	69-238	d8.9	21	1.12	0.97-1.50	± 0.06
Dog River	0.7	19%	23	112	79-185	ill.6	23	1.10	0.97-1.35	± 0.04
Tilly Jane Cr	0.1	1994	26	101	44-165	±10.7	25	1.01	0.70-1.29	± 0.05
Tilly Jane Cr	0.1	1995	115	75	30-183	± 7.3	114	1.18	0.10-4.03	± 0.07
Robinhood Cr	1.0	1994	54	104	39-200	±12.2	54	1.02	0.62-1.22	± 0.04
Robinhood Cr	1.0	19%	93	80	22-210	± 9.9	90	1.01	0.14-1.35	± 0.04
Robinhood Cr	1.0	19%	106	75	32-221	± 8.7	86	1.06	0.79-1.82	± 0.03

[a] Condition factor was estimated as $(100*weight(gms)/length(cm)^3)$.

Table 10. Estimates of mean fork length (FL: mm). weight (gm), and condition factor (CF) for wild downstream migrant cutthroat trout sampled at a juvenile migrant trap located at RM 4.5 in the mainstem Hood River. (Sampling periods are in APPENDIX B.)

Statistic. year	N	Mean	Range	95% C.I.
FL (mm),				
1994	17	175.5	142 - 202	± 0.7
1995	17	170.6	145 - 204	± 7.7
19%	24	170.1	97 - 215	± 10.2
Weight (gms),				
1994	14	55.8	29.0 - 89.0	± 10.5
1995	16	49.5	29.6 - 82.3	± 7.5
19%	22	50.0	8.5 - 81.9	± 17.5
CF.[a]				
1994	14	1.00	0.89 - 1.12	± 0.04
1995	16	0.96	0.86 - 1.03	± 0.03
19%	22	0.93	0.81 - 1.16	± 0.04

[a] Condition factor was estimated as $(100 * weight(gms)/length(cm)^3)$.

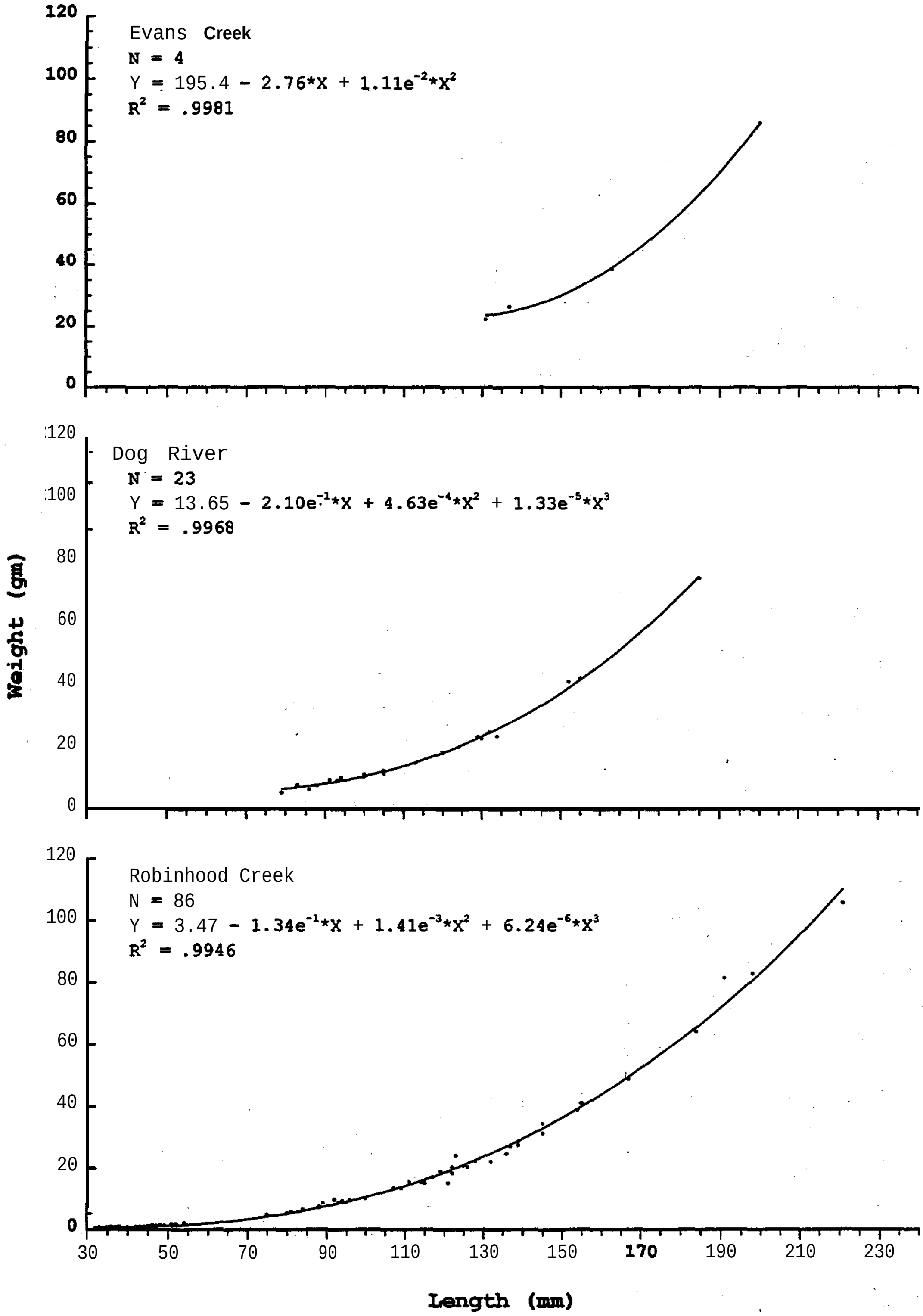

Figure 10. Length x weight regression of wild cutthroat trout sampled at selected sites in Evans and Robinhood creeks and in Dog River, 1996.

Table 11. Bimonthly counts of adult summer steelhead captured at the Powerdale Dan, trap by orlgln'and run year. Bimonthly counts are reported for M
years. counts are boldfaced for the bimonthly period In which the median date of migration occurred in each origin category (i.e.. 1992-93 through 199

Origin. run year	March 01-15	March 16-31	April 01-15	April 16-30	Hay 01-15	Hay 16-31	June 01-15	June 16-30	July 01-15	July 16-31	August 01-15	August 16-31	September 01-15	September 16-30	October 01-15	October 16-31	Noveml 01-15
Wild,																	
1992-93	0	1	12	6	7	21	31	68	49	49	37	18	17	55	25	24	38
1993-94	0	1	10	5	8	21	13	21	25	26	14	10	8	5	11	8	1
1994-95	0	1	3	4	9	7	22	25	32	33	11	1	4	8	2	7	5
1995-96"	0	0	0	0	2	1	4	6	37	19	16	2	5	5	2	B	0
1996-97[b]	0	0	0	1	3	3	13	17	31	31	14	6	5	5	16	10	4
Subbasln hatchery.																	
1992-93	0	8	48	82	131	191	136	279	253	220	136	28	26	55	24	10	15
1993-94	0	1	13	38	83	120	75	1%	194	169	115	34	24	8	17	10	0
1994-95	0	4	14	80	128	171	281	308	329	169	24	10	13	17	18	12	13
1995-96[a]	0	0	4	0	5	12	30	33	220	104	58	13	15	6	9	5	1
1996-97[b]	0	2	40	29	119	156	317	191	268	130	30	15	5	3	9	7	1
Stray hatchery.																	
1992-93	0	0	0	0	2	3	0	2	6	4	3	0	4	16	0	4	5
1993-94	0	0	0	1	0	0	2	2	7	0	1	3	0	0	1	0	0
1994-95	0	0	0	0	0	2	1	1	0'	0	0	0	0	0	0	0	0
1995-96[a]	0	0	0	0	0	0	0	1	1	2	0	D	0	0	0	0	1
1996-97[b]	0	0	0	0	0	0	3	2	4	2	1	2	0	0	1	4	1
Unknown.																	
1992-93	1	2	1	0	1	0	1	1	2	1	1	1	0	1	2	0	2
1993-94	0	0	0	0	1	0	0	3	5	0	0	2	0	1	0	0	0
1994-95	0	0	0	4	2	4	4	7	11	7	1	0	11	0	0	1	1
1995-96[a]	0	0	0	0	0	0	1	2	5	'3	7	0	0	0	0	0	0
1996-97[b]	0	0	D	0	6	3	1	1	2	5	1	0	2	2	2	3	6

[a] Powerdale Dam trap was inoperative from 11-13 Nov 1995 and from 20-24 Nov 1995 because of flood damage and from 28 Nov 1995 - 27 Feb 1996 for modifi
b Preliminary estimates. Summaries are complete through 31 December 1996.

Table 12. Bimonthly counts of adult summer steelhead captured at the Powerdale Dam trap by origin and run year. Bimonthly counts are reported for January through May.

Origin, run year	Mar-Dee	January 01-15	January 16-31	February 01-15	February 16-29	March 01-15	March 16-31	April 01-15	April 16-30	May 01-15	May 16-31	Total
Wild,												
1992-93	473	0	1	0	0	1	1	0	0	1	0	477
1993-94	198	16	2	0	1	2	1	2	6	0	0	228
1994-95	174	0	0	5	1	1	1	1	0	0	0	183
1995-96	115	0	0	0	0	1	0	1	4	1	0	122
Subbasin hatchery,												
1992-93	1.651	0	0	0	0	0	3	11	4	1	0	1.670
1993-94	1.070	4	2	0	0	1	2	7	7	0	0	1.093
1994-95	1.595	0	4	2	3	6	2	0	3	0	0	f.615
1995-96	529	0	0	0	0	4	0	1	1	0	0	535
Stray hatchery,												
1992-93	49	0	1	1	0	1	1	3	0	0	0	56
1993-94	18	0	0	0	0	0	0	1	0	0	0	19
1994-95	4	0	0	0	0	0	0	1	0	0	0	5
1995-96	8	0	0	0	0	0	0	0	0	0	0	8
Unknown.												
1992-93	18	0	0	0	0	0	0	0	0	0	0	18
1993-94	13	1	0	0	0	0	0	0	2	0	0	16
1994-95	53	0	0	0	0	0	0	1	0	0	0	5 4
1995-96	19	0	0	0	0	0	0	0	1	0	0	20

Table 13. Estimated harvest of adult summer steelhead in the Rood River sport fishery located from the mouth of the Hood River to 0.3 miles above Powerdale Dam (RM 4.8). 1996. Confidence limits (95%) are in parenthesis.

Period	Wild summer steelhead		Subbasin hatchery summer steelhead		Catch Rate
	Kept	Released	Kept	Released	(hrs/fish)
Jan 1-15	--	4 (4.9)	11 (7.6)	8 (9.3)	36
Jan 16-31	--	--	20 (16.7)	--	29
Feb 1-15	--	6 (8.0)	3 (3.4)	--	11
Feb 16-29	--	28 (24.4)	4 (8.1)	--	18
Mar 1-15	--	26 (26.6)	--	—	46
Mar 16-31	--	7 (10.9)	26 113.1)	--	62
Apr 1-15	--	57 (38.8)	126 (45.6)	2 (4.4)	14
Apr 16-30	--	15 (14.6)	68 (42.4)	--	23
May 1-15	--	--	75 (48.0)	--	27
May 16-31	--	6 (7.1)	143 (63.7)	a (9.3)	20
Jun 1-15	--	7 (8.8)	89 (34.0)	14 (20.0)	17
Jun 16-30	--	22 (21.9)	156 (90.4)	16 (15.6)	10
Jul 1-15	--	3 (5.7)	58 (40.0)	--	17
Jul 16-31	--	12 (14.3)	11 (18.9)	--	26
Aug 1-15	--	--	--	--	--
Aug 16-31	--	5 (8.3)	4 (7.5)	--	66
Sep 1-15	--	15 (19.0)	5 (8.7)	4 (4.6)	10
Sep 16-30	--	4 (5.5)	4 (7.9)	--	19
Oct 1-15'	--	--	—	--	--
Oct 16-31	4 (7.6)	--	--	—	46
Nov 1-15	--	4 (4.3)	6 (8.6)	--	35
Nov 16-30	--	16 (22.6)	--	—	14
Dec 1-15	--	12 (13.9)	8 (12.7)	3 (6.2)	7
Oec 16-31	--	12 (15.9)	—	--	46
Total	4 (7.6)	261 (74)	817 (150)	55 (30)	21[a]

[a] Estimate is for the period 1 January - 31 December.

Table 14. Adult summer steelhead escapements to the Powerdale Dam trap by origin, run year, and age category. Fish of unknown origin were allocated to origin categories based on scale analysis and the ratio of fish of known origin (see METHODS).

Origin, run year	Total escapement	Freshwater/Ocean age 1/1	1/2	1/3	1/4	2/1	2/2	2/3	2/4	3/1	3/2	3/3	4/2	Repeat spawners
Wild,														
1992-93	492	--	5	0	--	26	310	48	0	6	70	0	1	18
1993-94	244	--	1	2	—	11	108	53	3	5	44	7	0	10
1994-95	220	--	0	0	—	5	82	33	0	2	71	12	0	15
1995-96	132	--	0	0	—	15	82	18	0	2	11	1	0	3
Subbasin hatchery,														
1992-93	1.673	47	1.470	142	1	--	0	--	--	--	--	--	--	13
1993-94	1.093	36	813	234	3	—	0	--	--	--	--	--	--	7
1994-95	1.632	11	1.359	251	0	--	1	—	--	--	--	--	--	10
1995-96	545	61	417	59	0	--	1	—	--	--	--	--	--	7
Stray hatchery,														
1992-93	56	4	43	8	—	--	--	1	—	--	--			0
1993-94	19	1	14	4	—	--	--	0	--			--	--	0
1994-95	5	0	2	3	--	--	--	0	--					0
1995-96	8	2	3	2	—	—	—	0	--	--	--	--	--	1

Table 15. Adult summer steelhead escapements to the Powerdale Dam trap by origin. brood year, and ocean age category. Brood years are bold faced for those years in which brood year specific estimates of escapement are caapl'ete. (Percent return is in parentheses. Estimates are based on returns in the 1992-93 through 1995-96 run years.)

Origin. brood year[a]	Smolts	Ocean aoe 1 salt	2 salt	3 salt	4 salt	Repeat spawners
Wild.						
1986	--	--	1	0	0	3
1987	--	0	78	55	3	19
1988	--	6	354	65	0	15
1989	--	31	184	36	0	7
1990	--	13	94	18	--	2
1991	--	7	82	--	--	--
1992,	--	16	--		--	--
Subbasin hatchery.						
I987	79.867	--	--	--	1 (0.001)	--
1988	89.026	--	--	142 (0.16)	3 (0.003)	13 (0.01)
1989	81,795	--	1,470 (1.80)	234 (0.29)	0 (0.0)	7 (0.01)
1990	77.132	47 (0.06)	814 (1.06)	251 (0.33)	0	10 (0.01)
1991	99,973	36 (0.04)	1.360 (1.36)	59 (0.06)	--	7 (0.01)
1992	70.928	11 (0.02)	417 (0.59)	--	--	--
1993	68,378	61 (0.09)	--	--	--	--

[a] Complete brood returns are available beginning with the 1989 wild and 1990 hatchery broods. as determined based on age structure for adult summer steelhead sampled at the Powerdale Dam trap. Estimates of escapement for prior brood years do not include adult returns fran all possible age categories.

Table 16. Age composition (percent) of adult summer steelhead sampled at the Powerdale Dam trap by origin, run year, and age category. (Estimates in a given run year may not add to 100% due to rounding error.)

Origin, run year	N	Freshwater/ocean age 1/1	1/2	1/3	1/4	2/1	2/2	2/3	2/4	3/1	3/2	3/3	4/2	Repeat spawners
Wild,														
1992-93	477	--	1.0	0	--	5.2	62.9	9.6	0	1.3	15.9	0	0.2	3.8
1993-94	222	--	0.5	0.9	--	4.5	44.6	20.7	1.4	2.3	18.5	3.2	0	3.6
1994-95	176	--	0	0	--	2.3	40.3	13.1	0	0.6	31.2	5.1	0	7.4
1995-96	121	--	0	0	--	11.6	62.8	14.0	0	1.7	7.4	0.8	0	1.7
Subbasin hatchery.														
1992-93	1.669	2.8	87.8	8.5	0.06	--	0	--	--	--	--	--	--	0.8
1993-94	1,069	3.3	74.4	21.4	0.3	--	0	--	--	--	--	--	--	0.7
1994-95	1.569	0.7	83.2	15.4	0	--	0.06	--	--	--	--	--	--	0.6
1995-96	511	11.2	76.5	10.8	0		0.2	--	--	--	--	--	--	1.4
Stray hatchery,														
1992-93	56	7.1	76.8	14.3	--	--	--	1.8	--	--	--	--	--	0
1993-94	19	5.3	73.7	21.1	--	--	--	0	--	--	--	--	--	0
1994-95	5	0	40.0	60.0	--	--	--	0	--	--	--	--	--	0
1995-96	8	25.0	37.5	25.0	--	--	--	0	--	--	--	--	--	12.5

Table 17. Mean fork length (cm) of adult summer steelhead with spawning checks in the 1995-96 run year by origin, sex. and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop.. statistic	Freshwater/ocean age 1/2s.3	1/2s.4	3/2s.4
Natural,			
Females.			
N	--	--	1
Mean	--		73.5
STD	--	--	--
Range	--	--	73.5
Males.			
N	--	--	--
Mean	--		
STD-	--	--	--
Range	--	--	--
Total.			
N	--	--	1
Mean	--	--	73.5
STD	--	--	--
Range	--	--	73.5
Subbasin hatchery.			
Females,			
N	2	--	--
Mean	- 79.75	--	--
STD	3.18	--	--
Range	77.5-82.0	--	--
Males,			
N	2	2.	--
Mean	82.75	78.00	--
STD	4.60	3.54	--
Range	79.5-86.0	75.5-80.5	--
Total,			
N	4	2	--
Mean	81.25	78.00	--
STD	3.66	3.54	--
Range	77.5-86.0	75.5-80.5	..

Table 18. Mean fork length (cm) of adult summer steelhead without spawning checks in the 1995-96 run year by orlgin. sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	Freshwater/ocean age 1/1	1/2	1/3	2/1	2/2	2/3	3/1	3/2	3/3	Sample[a] mean
Natural,										
Females,										
N	--			9	53	7	2	6	—	79
Mean	--			58.83	67.35	76.86	57.00	69.00	--	66.89
STD	--	--	--	3.72	6.93	3.85	2.12	4.38	—	7.83
Range	--	--	--	55.5-66.5	41.5-79.0	73.5-85.0	55.5-58.5	65.5-77.5	--	41.5-85.0
Males,										
N	--			5	23	10	--	3	1	42
Mean	--			61.30	69.46.	82.45	--	65.67	81.0	71.58
STD	--			2.28	5.73	6.46	--	7.15	--	8.87
Range	--			58.0-63.5	56.5-78.0	71.5-90.0	--	59.5-73.5	81.0	56.5-90.0
Total										
N	--		--	14	76	17	2	9	1	121
Mean	--			59.71	67.99	80.15	57.00	67.89	81.0	68.52
STD	--			3.41	6.62	6.09	2.12	5.25	--	0.47
Range	--			55.5-66.5	41.5-79.0	71.5-90.0	55.5-58.5	59.5-77.5	81.0	41.5-90.0
Subbasln hatchery,										
Females,										
N	35	243	14	--	1	--	--	--	--	307
Mean	56.01	67.18	77.25	--	65.5	--	--	--	--	66.50
STD	2.69	3.82	4.06	--	--	--	--	--	--	5.74
Range	51.5-66.5	54.0-76.0	68.0-82.5	--	65.5	--	--	--	--	51.5-82.5
Males,										
N	22	'147	41	--	--	--	--	--	--	227
Mean	58.80	70.07	81.74	--	--	--	--	--	--	71.54
STD	4.89	4.57	4.05		--	--	--	--	--	7.77
Range	52.5-73.5	53.0-80.0	72.0-92.5		--	--	--	--	--	52.5-92.5
Total,										
N	57	390	55		1	--	--	--	--	534
Mean	57.09	68.27	80.60	--	65.5	--	--	--	--	68.64
STD	3.90	4.35	4.47	--	--	--	--	--	--	7.12
Range,	51.5-73.5	53.0-80.0	68.0-92.5	--	65.5	--	--	--	--	51.5-92.5

[a] Mean estimates include steelhead with spawning checks and steelhead in which the origin, but not the age of the fish could be determlned from the scale sample.

Table 19. Mean fork length (cm) of adult summer steelhead without spawning checks by origin, brood year, and age category. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables. Olsen et al. (1994), and Olsen et al. (1995).]

Origin, brood year	1/1	2/1	3/1	1/2	2/2	3/2	4/2	1/3	2/3	3/3	1/4	2/4
Wild,												
1986	--	--	--	--	--	--	64 (1)	--	--	--	--	--
1987	--	--	--	--	--	68 (76)	--	--	82 (46)	79 (7)	--	79 (3)
1988	--	--	54 (6)	--	70 (300)	66 (41)	--	--	80 (46)	79 (9)	--	--
1989	--	57 (25)	53 (5)	69 (5)	68 (98)	70 (55)	--	88 (2)	80 (23)	81 (1)	--	--
1990	--	55 (10)	54 (1)	70 (1)	69 (71)	68 (9)	--	--	80 (17)	--	--	--
1991	--	51 (4)	57 (2)	--	68 (76)	--	--	--	--	--	--	--
1992	--	60 (14)	--	--	--	--	--	--	--	--	--	--
Subbasin hatchery,												
1987	--	--	--	--	--	--	--	--	--	--	90 (1)	--
1988	--	--	--	--	--	--	--	78 (142)	--	--	79 (3)	--
1989	--	--	--	68 (1,466)	--	--	--	80 (229)	--	--	--	--
1990	55 (47)	--	--	67 (793)	75 (1)	--	--	79 (239)	--	--	--	--
1991	53 (35)	--	--	69 (1,302)	66 (1)	--	--	81 (55)	--	--	--	--
1992	53 (11)	--	--	68 (390)	--	--	--	--	--	--	--	--
1993	57 (57)	--	--	--	--	--	--	--	--	--	--	--

Table 20. Mean weight (kg) of adult summer steelhead without spawning checks in the 1995-96 run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	Freshwater/ocean age 1/1	1/2	1/3	2/1	2/2	2/3	3/1	3/2	3/3	Sample[a] mean
Natural,										
Females.										
N	--	--	--	8	52	7	2	6	--	77
Mean	--	--	--	2.29	3.14	4.44	2.00	3.38	--	3.15
STD	--	--	--	0.66	0.81	0.82	0.14	0.62	--	0.95
Range	--	--	--	1.6-3.5	0.9-5.0	3.7-6.1,	1.9-2.1	2.9-4.6	--	0.9-6.1
Males,										
N	--	--	--	5	23	10	--	3	1	42
Mean	--	--	--	2.22	3.37	5.53	--	3.47	5.0	3.79
STD	--	--	--	0.26	0.85	1.48	—	0.83	--	1.44
Range	--	--	--	2.0-2.5	1.8-4.6	3.5-7.9	--	2.0-4.4	5.0	1.8-7.9
Total,										
N	--	--	--	13	75	17	2	9	1	119
Mean	--	--	--	2.26	3.21	5.08	2.00	3.41	5.0	3.38
STD	--	--	--	0.53	0.82	1.34	0.14	0.65	--	1.18
Range	--	--	--	1.6-3.5	0.9-5.0	3.5-7.9	1.9-2.1	2.8-4.6	5.0	0.9-7.9
Subbasin hatchery.										
Females.										
N	33	227	12	—	1	—	—	—	—	207
Mean	1.85	3.07	4.73	--	2.9	--	—	—	--	3.02
STD	0.29	0.49	0.63	--	--	--	--	--	—	0.73
Range	1.3-2.8	1.3-4.3	3.8-5.5	—	2.9	--	--	--	--	1.3-5.5
Males.										
N	21	141	39	--	—	--	--	--	--	214
Mean	2.13	3.42	5.42	—	--	--	--	--	--	3.71
STD	0.53	0.62	0.89	--	--	--	--	—	—	1.17
Range	1.7-3.9	1.9-5.1	3.6-7.8	—	—	--	--	—	--	1.1-7.8
Total,										
N	54	368	51	—	1	--	--	—	—	501
Mean	1.96	3.21	5.25	—	2.9	—	—	—	—	3.32
STD	0.42	0.57	0.88	—	--	--	—	--	—	1.00
Range	1.3-3.9	1.3-5.1	3.6-7.8	--	2.9	--	--	—	--	1.1-7.8

[a] Mean estimates include steelhead with spawning checks and steelhead in which the origin, but not the age of the fish could be determined from the scale sample

Table 21. Mean weight (kg) of adult summer steelhead without spawning checks by origin, brood year, and age category. [Sample size is in parentheses. Sample statistics, by run year. are presented in previous tables and in Olsen et al. (1995).]

Origin,	Freshwater/ocean age											
brood year	1/1	2/1	3/1	1/2	2/2	3/2	4/2	1/3	2/3	3/3	1/4	2/4
Wild,												
1988	—	--	--	--	--	—	--	--	--	5.3 (9)	--	--
1989	--	--	--	--	—	3.6 (54)	--	--	5.2 (23)	5.0 (1)	--	--
1990	--	—	--	—	3.4 (70)	3.4 (9)	--	--	5.1 (17)	--	--	--
1991	--	1.6 (3)	2.0 (2)	--	3.2 (75)	--	--	--	—	--	--	--
1992	--	2.3 (13)	--	--	--	—	--	--	--	--	--	--
Subbasin hatchery,												
1990	--	--	--	--	4.1 (1)	--	--	5.1 (183)	--	--	--	--
1991	--	--	--	3.4 (1,063)	2.9 (1)	--	--	5.2 (51)	--	--	--	--
1992	1.6 (10)	--	--	3.2 (368)	--	--	--	--	--	--	--	--
1993	2.0 (54)	--	--	--	--	--	--	--	--	--	--	--

Table 22. Adult summer steelhead sex ratios as a percentage of females by origin. run year. and age category. Fish were sampled at the Powerdale Dam trap. (Sample size is in parentheses.)

Origin. run year	Freshwater/ocean age 1/1	1/2	1/3	1/4	2/1	2/2	2/3	2/4	3/1	3/2	3/3	4/2	Repeat spawners
Wild.													
1992-93	--	60 (5)	--	--	72 (25)	79 (300)	28 (46)	--	83 (6)	80 (76)	--	100 (1)	69 (16)
1993-94	--	0 (1)	50 (2)	--	30 (10)	76 (98)	40 (46)	100 (3)	40 (5)	73 (41)	29 (7)	--	75 (8)
1994-95	--	--	--	--	75 (4)	79 (71)	40 (23)	--	100 (1)	65 (55)	44 (9)	--	a2 (11)
1995-96	--	--	--	--	64 (14)	70 (76)	41 (17)	--	100 (2)	67 (9)	0 (1)	--	100 (1)
Subbasin hatchery,													
1992-93	47 (47)	73 (1.466)	34 (142)	0 (1)	--	--	--	--	--	--	--	--	77 (13)
1993-94	60 (35)	76 (793)	43 (229)	100 (3)	--	--	--	--	--	--	--	--	50 (6)
1994-95	36 (11)	62 (1,302)	41 (239)	--	--	0 (1)	--	--	--	--	--	--	60 (10)
1995-96	61 (57)	62 (390)	25 (55)	--	--	100 (1)	--	--	--	--	--	--	33 (6)

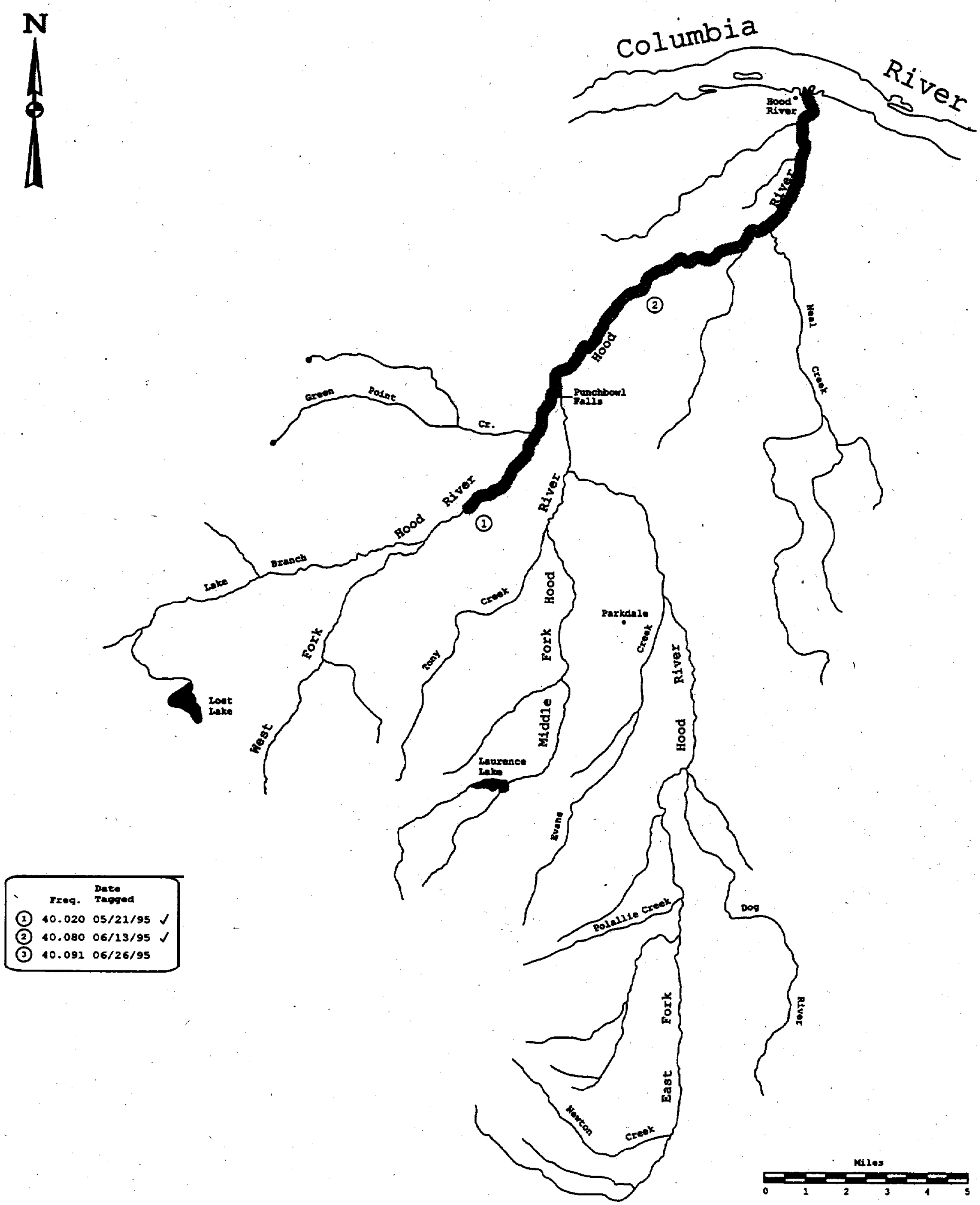

Figure 11. Maximum spatial distribution of radio-tagged wild and hatchery'adult summer steelhead during June 1995. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1995-96 run year. Highlighted numbers signify hatchery produced summer steelhead.

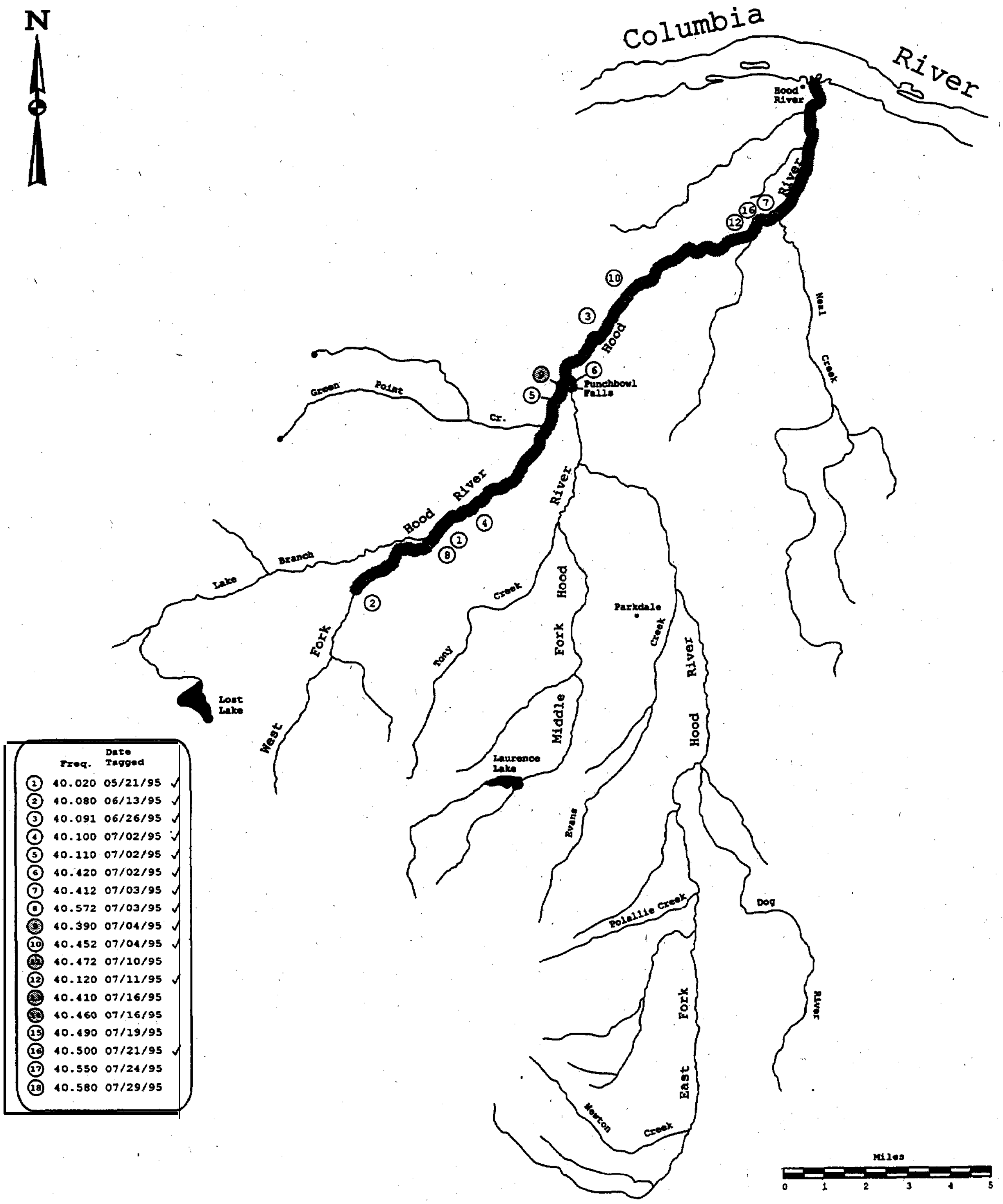

Figure 12. Maximum spatial distribution of radio-tagged wild and hatchery adult summer steelhead during July 1995. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1995-96 run year. Highlighted numbers signify hatchery produced summer steelhead.

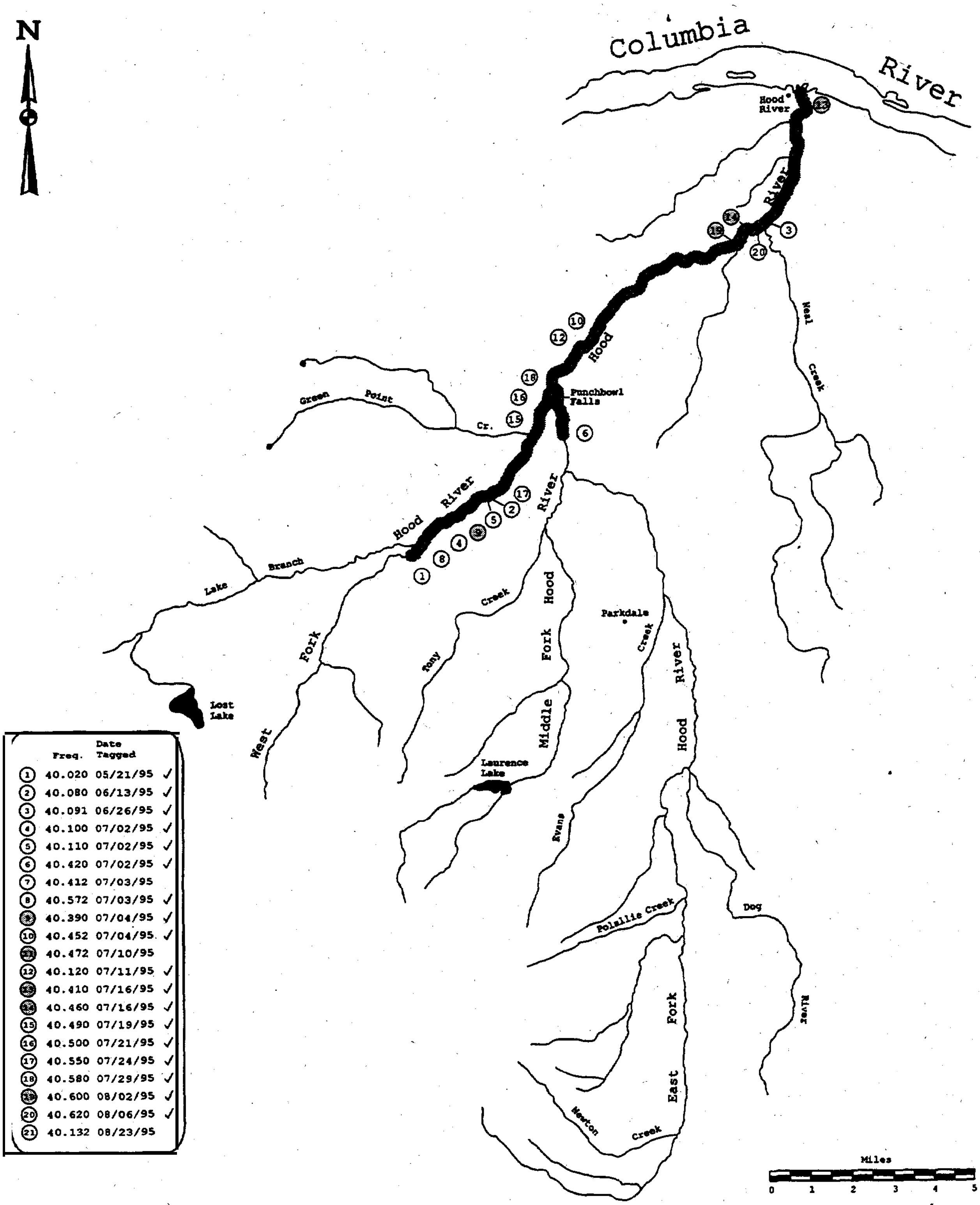

Figure 13. Maximum spatial distribution of radio-tagged wild and hatchery adult summer steelhead during August 1995. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1995-96 run year. Highlighted numbers signify hatchery produced summer steelhead.

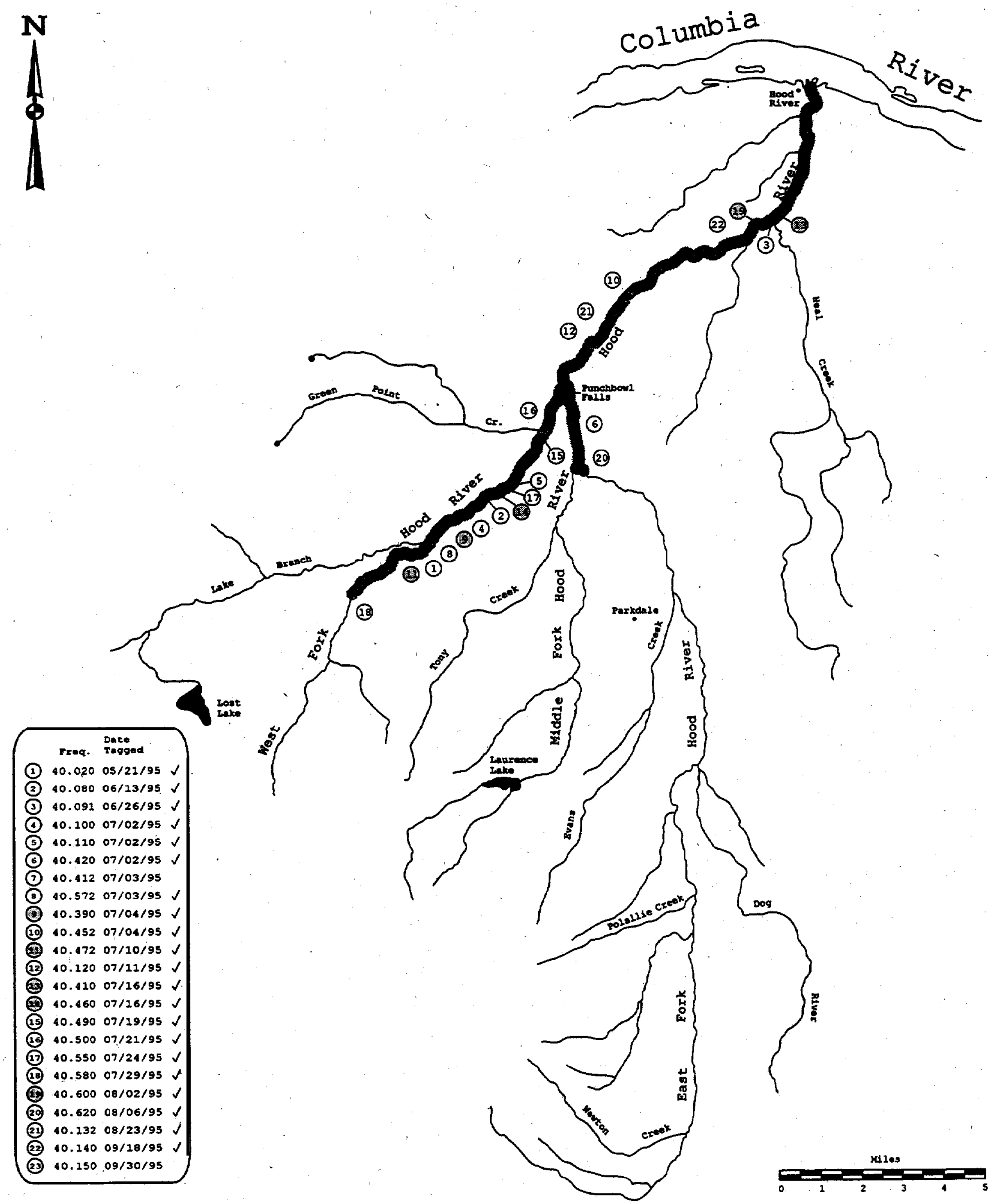

Figure 14. Maximum spatial distribution of radio-tagged wild and hatchery adult summer steelhead during September 1995. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1995-96 run year. Highlighted numbers signify hatchery produced summer steelhead.

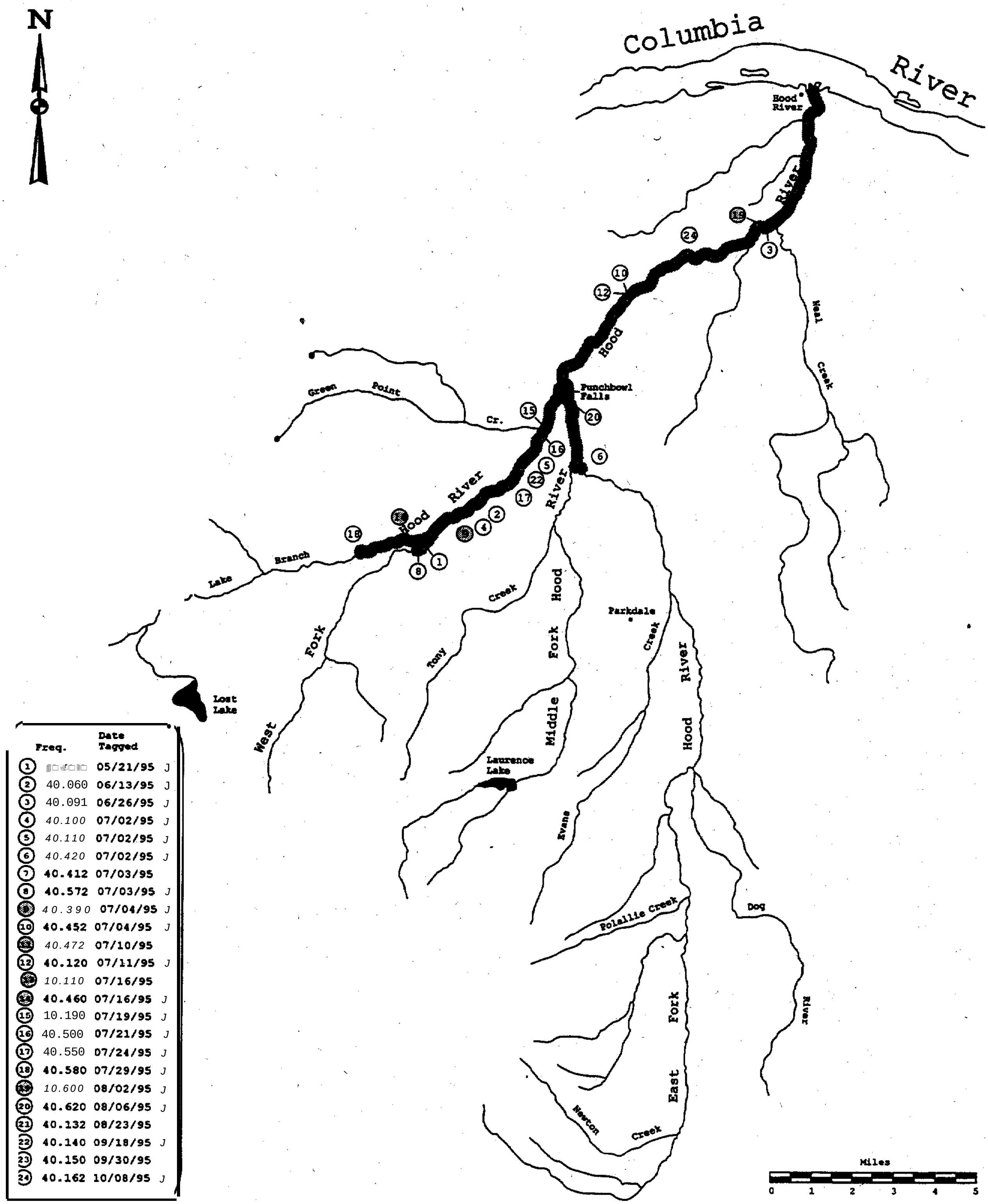

Figure 15. Maximum spatial distribution of radio-tagged wild and hatchery adult summer steelhead during October **1995.** Frequencies detected during the period are marked with a check **("✓").** 'Radio-tagged summer steelhead are from the **1995-96** run year. Highlighted numbers signify hatchery produced summer steelhead.

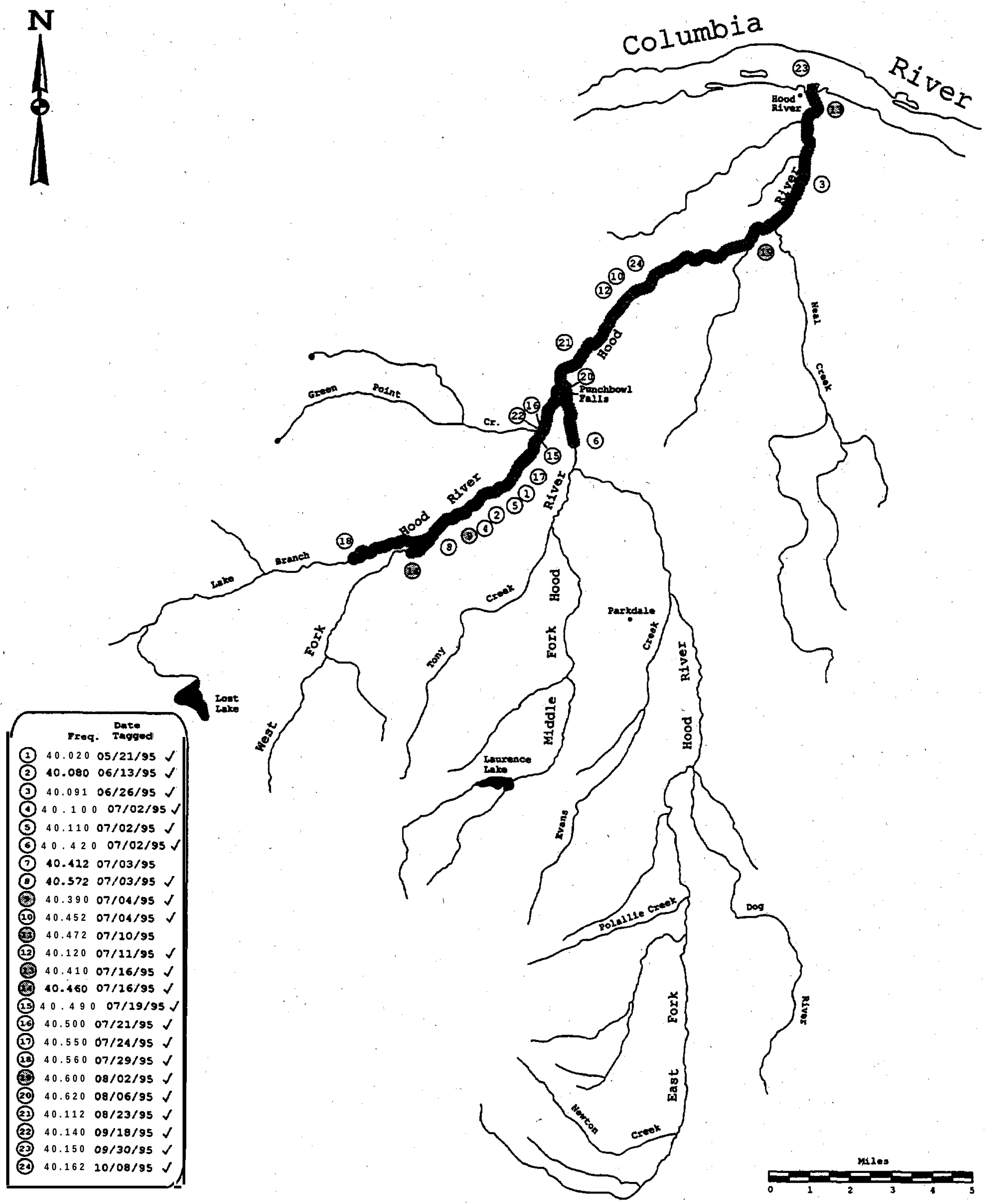

Figure 16. Maximum spatial distribution of radio-tagged wild and hatchery adult summer steelhead during November 1995. Frequencies detected during the period are marked with a' check ("✓"). Radio-tagged suniner steelhead are from the 1995-96 run year. Highlighted numbers signify hatchery produced summer steelhead.

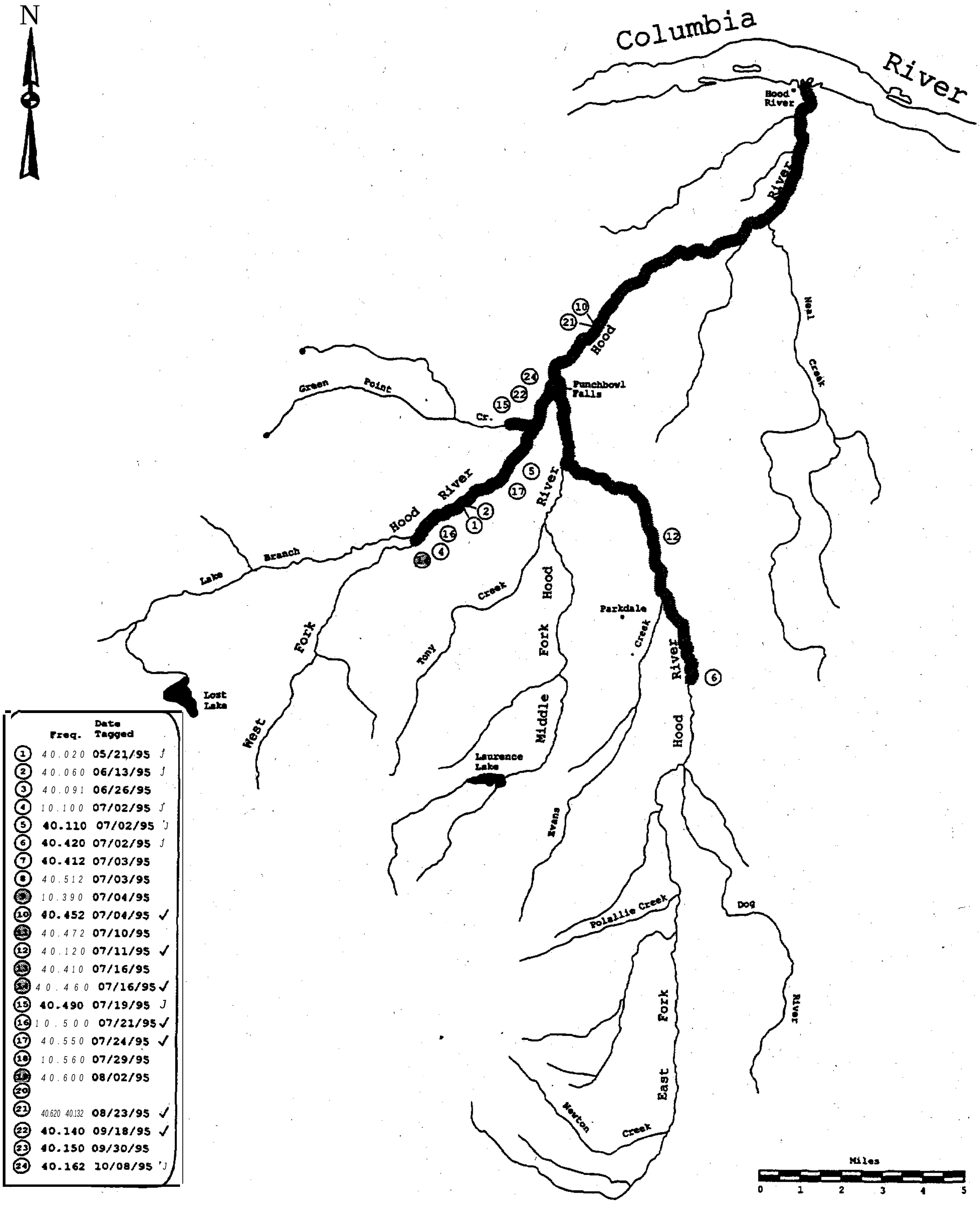

Figure 17. Maximum spatial distribution of radio-tagged wild and hatchery adult summer steelhead during December 1995. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1995-96 run year. Highlighted numbers signify hatchery produced summer steelhead.

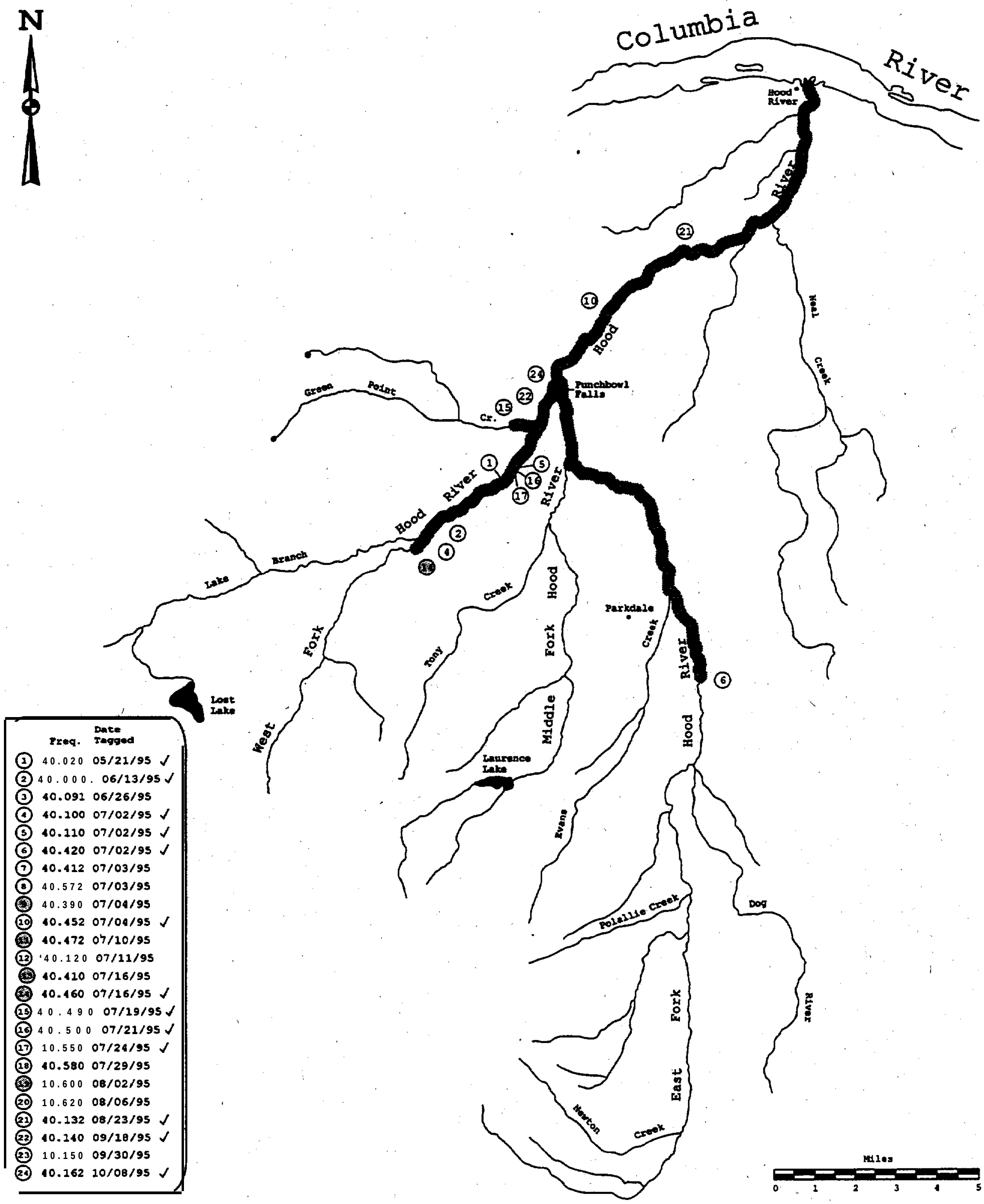

Figure 18. Maximum spatial distribution of radio-tagged wild and hatchery adult summer steelhead during January 1996. Frequencies detected during the period are marked with a check("✓"). Radio-tagged summer steelhead are from the 1995-96 run year. Highlighted numbers signify hatchery produced summer steelhead.

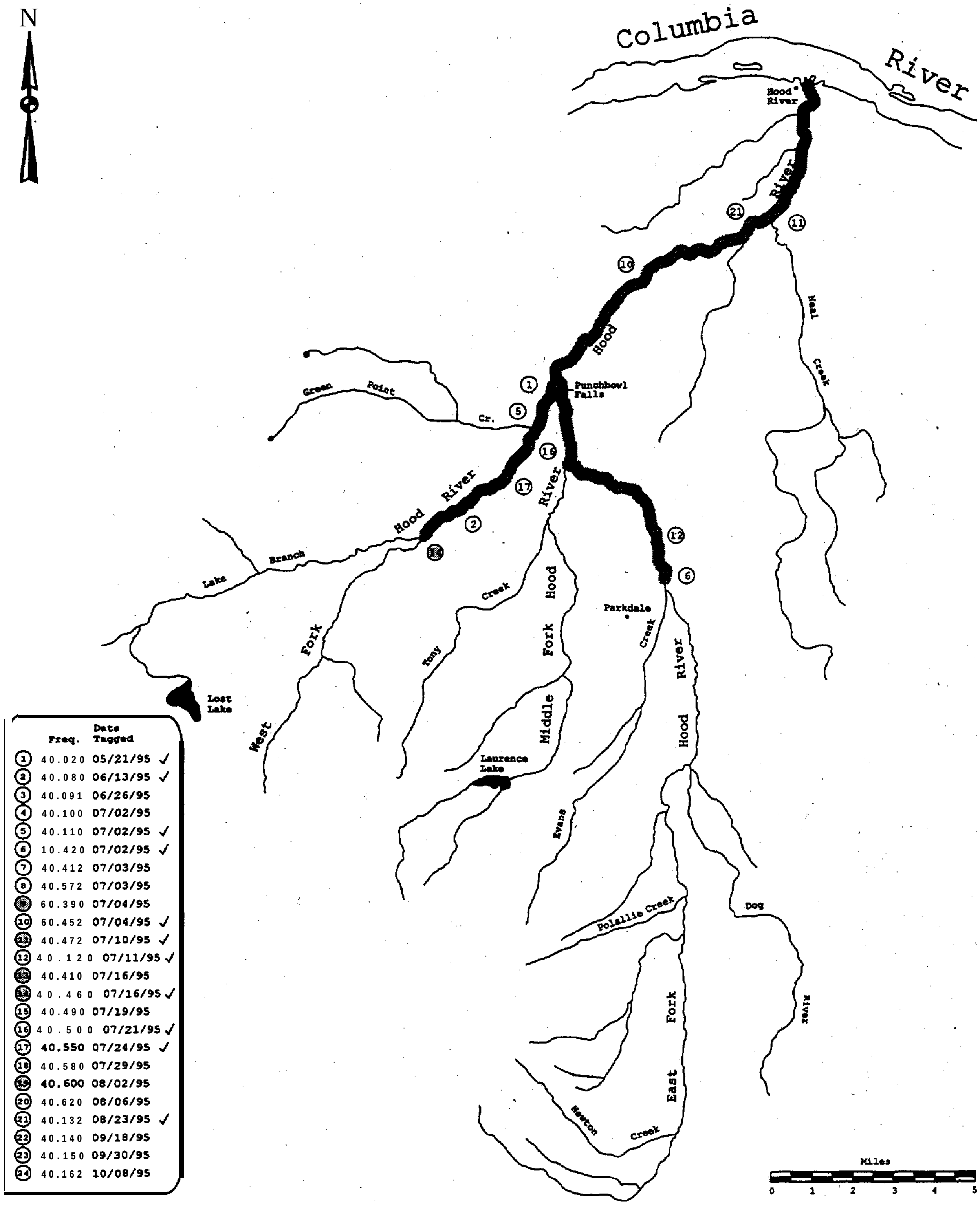

Figure 19. Maximum spatial distribution of radio-tagged wild and hatchery adult summer steelhead during February 1996. Frequencies detected during the period are marked with a check("✓"). Radio-tagged summer steelhead are from the 1995-96 run year. Highlighted numbers signify hatchery produced summer steelhead.

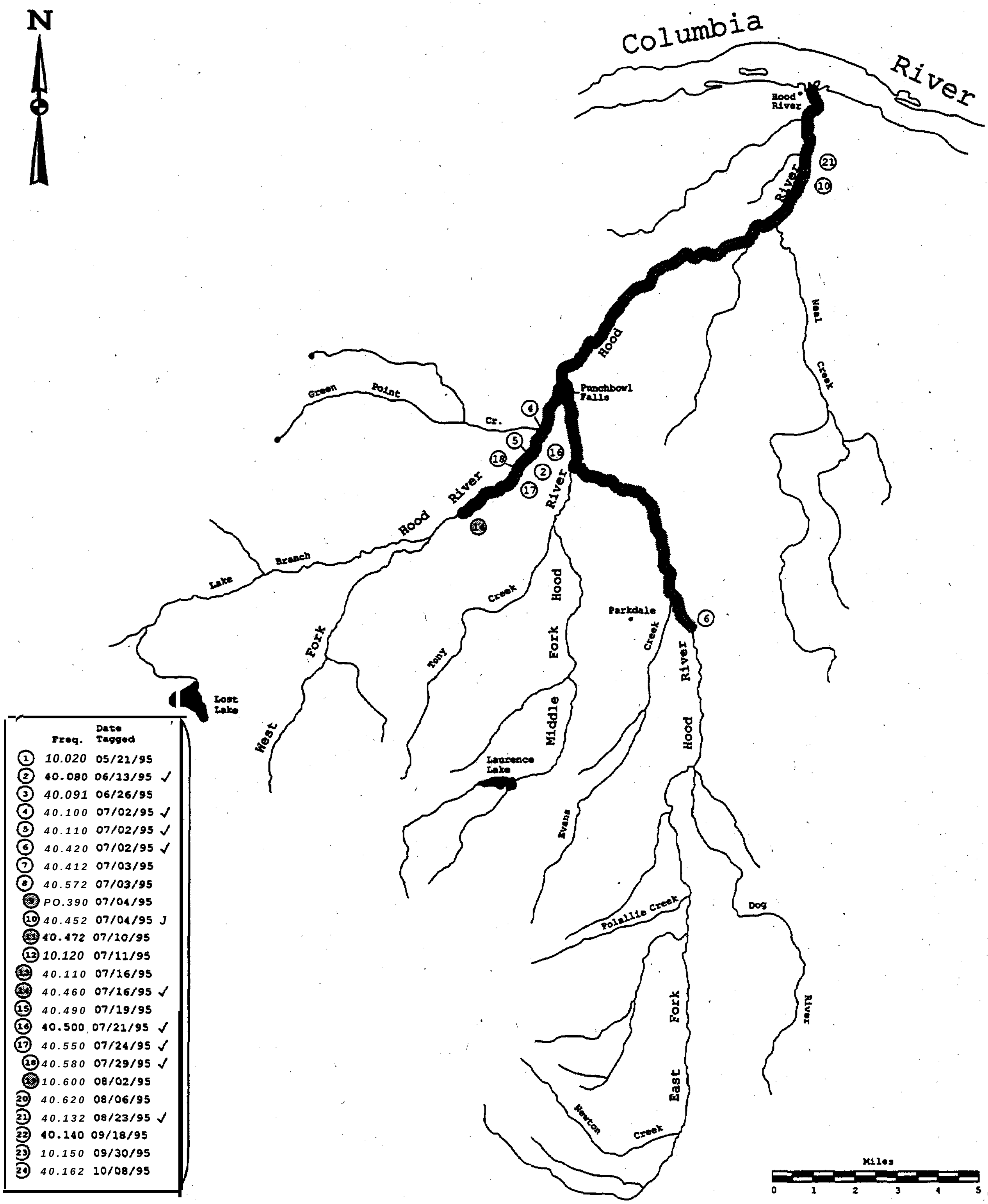

Figure 20. Maximum spatial distribution of radio-tagged wild and hatchery adult summer steelhead during March 1996. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1995-96 run year. Highlighted numbers signify hatchery produced summer steelhead.

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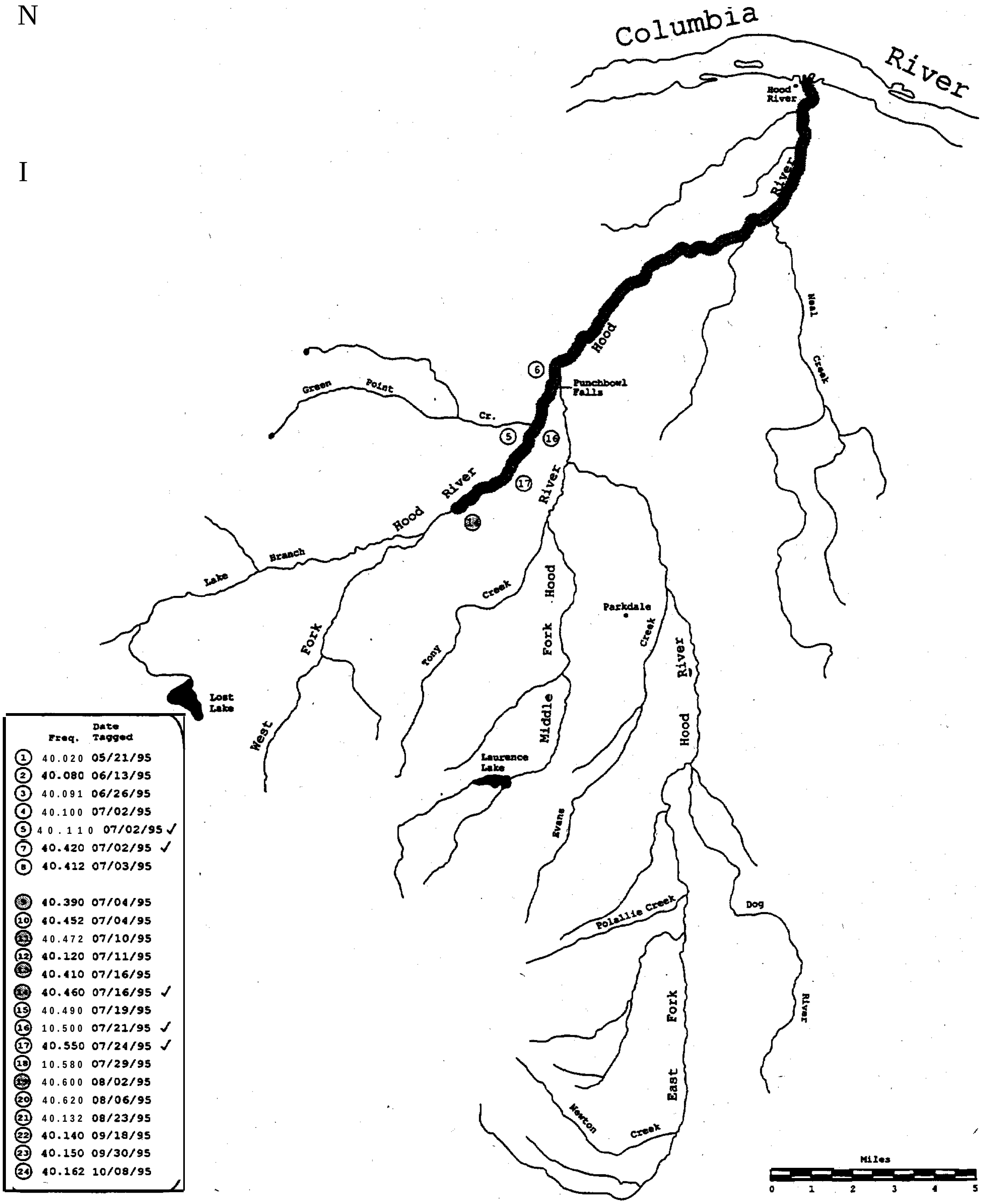

Figure 21. Maximum spatial distribution of radio-tagged wild and hatchery adult summer steelhead during April 1996. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged summer steelhead are from the 1995-96 run year. Highlighted numbers signify hatchery produced summer steelhead.

Table 23. Bimonthly counts of upstream migrant adult winter steelhead captured at the Powerdale Dam trap, by origln and run year. Counts are boldfaced for the bimonthly period in which the median date of migration occurred in each **origin** category.

Origin, run year	November 01-15	November 16-30	December 01-15	December 16-31	January 01-15	January 16-31	February 01-15	February 16-29	March 01-15	March 16-31	April 01-15	April 16-30	May 01-15	May 16-31	June 01-15	June 16-30	Total
Wild,																	
1991-92	0	0	0	**0**	**0**	24	28	32	75	98	153	149	88	29	2	0	678
1992-93	0	0	0	**4**	**0**	2	3	0	28	61	99	70	86	30	3	2	396
1993-94	0	0	0	**0**	4	7	0	6	23	25	77	128	76	21	11	0	378
1994-95	0	0	0	**0**	0	0	9	0	6	2	55	15	52	44	10	1	194
1995-96	0	0	0	**0**	0	0	0	0	17	4	93	40	69	36	11	0	270
Subbasin hatchery,																	
1991-92	0	0	0	5	15	114	59	49	33	5	2	2	0	0	0	0	284
1992-93	0	0	2	i5	0	34	48	0	42	32	18	13	3	0	0	0	207
1993-94	0	0	0	0	29	32	**8**	37	33	5	3	2	0	0	0	0	149
1994-95	0	0	0	0	0	b	31	19	11	4	24	3	6	1	0	0	105
1995-96	0	2	0	0	0	0	0	0	21	8	97	49	66	21	3	0	267
Stray hatchery,																	
1991-92	0	0	0	0	0	3	5	1	6	6	7	**3**	1	1	0	0	33
1992-93	0	0	0	1	0	4	3	0	3	9	'7	**1**	1	0	0	0	29
1993-94	0	0	0	0	2	1	0	0	2	3	11	**8**	0	0	0	0	27
1994-95	0	0	0	1	0	0	0	1	1	1	0	**0**	1	0	0	0	5
1995-96	0	0	0	0	0	0	0	0	3	1	2	**3**	0	0	0	0	9
Unknown.																	
1991-92	0	0	0	0	0	1	1	0	2	3	3	**7**	3	1	0	0	21
1992-93	0	0	1	1	0	1	1	0	2	4	3	**2**	2	0	0	0	17
1993-94	0	0	0	0	1	1	0	0	4	8	5	**3**	3	2	0	0	27
1994-95	0	0	0	0	0	0	2	2	1	0	2	**1**	2	2	2	0	14
1995-96	0	0	0	0	0	0	0	0	0	1	5	**0**	5	3	0	0	14

Table 24. Estimated harvest of adult winter steelhead in the Hood River sport fishery located from the mouth of the Hood River to 0.3 miles above Powerdale Dam (RM 4.8). 19%. Confidence limits (95%) are in parenthesis.

Period	Wild winter steelhead Kept	Wild winter steelhead Released	Subbasin hatchery winter steelhead Kept	Subbasin hatchery winter steelhead Released	Catch Rate (hrs/fish)
Jan 1-15	--	13 (15.4)	40 (18.9)	7 (7.3)	13
Jan 16-31	--	21 (20.5)	27 (28.5)	1 (2.8)	12
Feb 1-15		—	3 (3.4)		32
Feb 16-29	--	7 (9.9)	22 (20.0)	--	20
Mar 1-15	--	41 (26.0)	52 (32.0)	4 (7.2)	12
Mar 16-31	--	155 (49.6)	101 (44.7)	6 (10.0)	8
Apr 1-15	--	19 (15.1)	48 (31.5)		39
Apr 16-30	--	9 (10.4)	16 (14.2)		75
May 1-15	--	10 (12.5)	66 (47.3)		26
May 16-31	--	2 (3.8)	4 (6.4)	11 (16.2)	186
Jun 1-15	--	--	14 (17.5)	--	132
Jun 16-30			--	—	—
Jul 1-15	--	--	--		--
Jul 16-31	--	--	--		
Aug 1-15	--	--	--		
Aug 16-31	--	--	--		
Sep 1-15	--	--	--		--
Sep 16-30	--	--	--	--	--
Oct 1-15	--	--	--	--	
Oct 16-31			--	--	--
Nov 1-15				--	
Nov 16-30	--	--	--		--
Oec 1-15	--	3 (6.2)	3 (6.8)		23
Oec 16-31	--	—	14 (17.1)		39
Total	--	280 (67)	410 (93)	29 (22)	24[a]

[a] Estimate is for the period 1 January - 15 June and 1 December - 31 December.

Table 25. Adult winter steelhead escapements to the Powerdale Dam trap by origin. stock, run year. and age category. Fish of unknown **origin** were allocated to origin categories based on scale analysis and the ratio of flsh of known origin (see METHODS).

Origin. stock. run year	Total escapement	Freshwater/ocean age 1/1	1/2	1/3	114	2/1	2/2	2/3	2/4	3/1	3/2	3/3	3/4	4/2	Repeat spawners
Wild,															
Hood River.															
1991-92	699	—	3	4	0	9	425	76	0	1	111	17	0	1	52
1992-93	412	—	2	6	0	36	174	123	1	1	20	17	0	0	32
1993-94	406	--	2	6	0	9	274	80	D	1	17	4	0	0	13
1994-95	206	--	1	1	0	28	107	34	1	3	9	3	1	0	18
1995-96	280	—	12	1	1	18	183	29	0	1	22	6	0	0	7
Subbasin hatchery,															
Big Creek.															
1991-92	284	--	264	7	—	--	6	1	--	—	--	--	--	--	6
1992-93	202	--	63	131	--	--	0	0	--	—	--	--	--	--	8
1993-94	135	--	--	62	--	--	69	0	--	--	--	--	--	--	4
1994-95	10	--	--	--	--	--	—	7	—	--	--	--	--	—	3
Mixed.[a]															
1992-93	6	6	--	--	--	--	—	—	—	--	--	--	--	—	--
1993-94	13	--	13	--	--	--	--	—	--	—	--	--	--		
1994-95	B	--	--	2	--	--	6	--	—	—	--	—	--	--	--
Hood River,															
1993-94[b]	0	0	—	--	—	--	--	—	--	--	--	--	--	--	0
1994-95	89	11	77	--	--	--	--	--	--	--	--	--	—	--	1
1995-96	271	10	244	17	--	--	—	--	—	—	--	—	—	--	0
Stray hatchery.															
Unknown,															
1991-92	33	0	19	13	0	--	0	--	--	--	--	—	—	--	1
1992-93	29	0	17	9	0	--	0	--	--	—	—	—	—	—	3
1993-94	27	1	1	22	1	--	1	--	--	--	--	--	--	--	1
1994-95	5	1	2	2	0	--	0	—	--	--	--	--	—	—	D
1995-96	9	0	a	0	0	--	0	--	--	—	--	—	—	--	1

[a] Returns **from** the **1991** brood are progeny of wild x **Big** Creek stock hatchery crosses.

[b] The **1993-94 run** year is the first run year in which the Hood River stock **(1992** brood) would have had the potential for returning as adults to Powerdale Dam. These fish would have returned as age category **1/1** adults. None were sampled at the Powerdale Dam trap.

Table 26. Adult winter steelhead escapements to the Powerdale Dam trap by origin, stock. brood year. and ocean age category. (Percent return is in parentheses. Brood years are bold faced for those years in which brood year specific estimates of escapement are complete. Estimates are based on returns in the 1991-92 through 1995-96 run years.)

Origin, stock, brood year[a]	Smolts	Ocean age: 1 salt	2 salt	3 salt	4 salt	Repeat spawners
Wild,						
Hood River,						
1985			--	--	--	2
1986	--		1	17	0	19
1987		--	111	93	1	39
1988	--	1	445	131	1	23
1989	--	10	194	89	1	13
1990		37	285	46	0	18
1991	--	12	231	30	1	6
1992	--	29	184	1	--	2
1993	--	18	12	--		
Subbasin hatchery.						
Big Creek,						
1987	28.000	--	--	1 (0.004)	--	2 (0.007)
1988	4.890		6 (0.12)	7 (0.14)	--	4 (0.08)
1989	36.038		264 (0.73)	131 (0.36)	--	9 (0.02)
1990	20.434		132 (0.66)	69 (0.35)	--	6 (0.03)
Mixed.[b]						
1991	4.595	6 (0.15)	19 (0.46)	2 (0.04)		
Hood River.						
1992	48,985	0 (0)	78 (0.16)	17 (0.03)	--	1 (0.002)
1993	38.034	11 (0.03)	244 (0.64)	--	--	--
1994	42.860	10 (0.02)	--	--	--	--

[a] Complete brood returns are available beginning with the 1989 wild and 1990 hatchery broods. as determined based on age structure for adult winter steelhead sampled at the Powerdale Dam trap. Estimates of escapement for prior brood years do not include adult returns from all possible age categories.

[b] Returns from the 1991 brood are progeny of wild x Big Creek stock hatchery crosses.

Table 27. Age composition (percent) of adult winter steelhead sampled at the Powerdale Dam trap by origin, stock, and run year. (Estimates In a given run year may not add to 100% due to rounding error.

Origin, stock, run year	N	Freshwater/ocean age 1/1	1/2	1/3	1/4	2/1	2/2	2/3	2/4	3/1	3/2	3/3	3/4	4/2	Repeat spawners
Wild,															
Hood River,															
1991-92	663	--	0.5	0.6	0	1.4	60.8	10.7	0	0.2	16.0	2.4	0	0.2	7.4
1992-93	393	--	0.5	1.5	0	8.7	42.5	29.8	0.3	0.3	4.8	3.8	0	0	7.9
1993-94	371	--	0.5	1.6	0	2.2	67.7	19.4	0	0.3	4.0	1.1	0	0	3.2
1994-95	190	--	0.5	0.5	0	13.7	51.1	16.8	0.5	1.6	4.2	1.6	0.5	0	8.9
1995-96	268	--	4.1	0.4	0.4	6.7	65.2	10.4	0	0.4	7.8	2.2	0	0	2.6
Subbasin hatchery,															
Big Creek,															
1991-92	245	--	93.1	2.4	--	--	2.0	0.4	—	--	—	--	--	—	2.0
1992-93	185	--	31.4	64.9	--	—	0	0	--	—	--	--	--	—	3.8
1993-94	129	--	--	45.7	--	—	51.2	0	--	—	--	--	--	—	3.1
1994-95	9	--	--	--	--	--	--	66.7	--	--	--	--	--	—	33.3
Mixed,[a]															
1992-93	6	100	--	--	--	--	--	--	—	—	--	—	--	--	
1993-94	13	--	100	—	--	--	--	—	--	—	--	--	--	—	
1994-95	8	--	--	25.0	—	—	75.0	—	--	--	—	--	--	--	--
Hood River,															
1994-95	82	12.2	86.6	--	--	—	—	—	—	—	—	--	--	—	1.2
1995-96	259	3.9	90.0	6.2	--	—	--	—	--	--	—	—	--	—	0
Stray hatchery.															
Unknown,															
1991-92	32	0	57.6	39.4	0	—	0	--	—	—	--	--	--	--	3.1
1992-93	29	0	58.6	31.0	0	--	0	--	--	--	—	--	--	--	10.3
1993-94	25	4.0	4.0	80.0	4.0	--	4.0	--	--	--	—	--	--	—	4.0
1994-95	5	20.0	40.0	40.0	0	--	0	—	--	--	—	--	--	—	0
1995-96	9	0	88.9	0	0	--	0	--	--	--	--	—	--	—	11.1

[a] Returns **from** the 1991 brood are progeny of wild x Big Creek stock hatchery crosses.

Table 28. Mean fork length (cm) of adult winter steelhead with spawning checks in the 1995-96 run year by origin. sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop.. statistic	Freshwater/ocean age 1/2s.3	2/1s.2	2/2s.3	2/2s.3s.4
Wild,				
Female.				
N	--	--	3	1
Mean	--	--	75.50	75.0
STD	--	--	3.97	--
Range	--	--	72.5-80.0	75.0
Male.				
N	1	1	1	--
Mean	67.5	67.5	70.0	--
STD	--	--	--	--
Range	67.5	67.5	70.0	--
Total.				
N	1	1	4	1
Mean	67.5	67.5	74.12	75.5
STD	--	--	4.25	--
Range	67.5	67.5	70.0-80.0	75.5

Table 29. Mean fork length (cm) of adult winter steelhead without spawning checks in the 1995-96 run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	Freshwater/ocean age 1/1	1/2	1/3	1/4	2/1	2/2	2/3	3/1	3/2	3/3	Sample[a] mean
Natural.											
Females.											
N	--	5	1	--	4	115	19	--	9	3	158
Mean	--	67.30	73.5	--	57.00	67.40	77.74	--	66.56	78.33	68.78
STD	--	3.46	--	--	5.61	4.48	4.14	--	2.79	3.69	6.01
Range	--	62.5-72.0	73.5	--	52.0-64.5	52.0-79.0	73.0-86.5	--	62.5-72.5	75.5-82.5	52.0-86.5
Males.											
N	--	6	--	1	14	61	9	1	12	3	110
Mean	--	60.83	--	88.5	50.32	68.94	82.56	48.0	67.42	81.67	67.83
STD	--	4.89	--	--	5.11	5.12	7.16	--	5.90	7.64	9.89
Range	--	61.0-75.0	--	88.5	42.0-58.0	50.0-80.5	70.0-90.0	48.0	57.5-75.0	75.0-90.0	42.0-90.0
Total,											
N	--	11	1	1	18	176	28	1	21	6	268
Mean	--	68.14	73.5	88.5	51.81	67.93	79.29	48.0	67.05	80.00	68.39
STD	--	4.17	--	--	5.80	4.75	5.64	--	4.74	5.67	7.84
Range	--	61.0-75.0	73.5	88.5	42.0-64.5	50.0-80.5	70.0-90.0	48.0	57.5-75.0	75.0-90.0	42.0-90.0
Subbasin hatchery											
Females.											
N	--	86	10	--	--	--	--	--	--	--	100
Mean	--	64.53	75.45	--	--	--	--	--	--	--	65.56
STD	--	3.20	2.93	--	--	--	--	--	--	--	4.56
Range	--	58.0-74.0	70.5-79.0	--	--	--	--	--	--	--	58.0-79.0
Males.											
N	10	146	5	--	--	--	--	--	--	--	165
Mean	45.75	66.68	80.80	--	--	--	--	--	--	--	65.91
STD	1.96	3.77	6.86	--	--	--	--	--	--	--	6.88
Range	41.0-48.5	57.5-79.0	69.5-85.5	--	--	--	--	--	--	--	41.0-85.5
Total.											
N	10	232	15	--	--	--	--	--	--	--	267
Mean	45.75	65.88	77.23	--	--	--	--	--	--	--	65.82
STD	1.96	3.71	5.08	--	--	--	--	--	--	--	6.10
Range	41.0-48.5	57.5-79.0	69.5-85.5	--	--	--	--	--	--	--	41.0-85.5

[a] Mean estimates include steelhead with spawning checks and steelhead in which the origin, but not the age of the fish could be determined from the scale sample.

Table 30. Mean fork length (cm) of adult winter steelhead without spawning checks by origin. stock, brood year, and age category. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables, Olsen et al. (1994). Olsen et al. (1995), and Olsen et al. (1996).]

Origin, stock, brood year	Freshwater/ocean age 1/1	2/1	3/1	1/2	2/2	3/2	4/2	113	2/3	3/3	1/4	2/4	3/4
Wild,													
Hood River.													
1986	--	—	--	--	--	--	60 (1)	--	--	78 (16)	--	--	
1987	--	—	--	--	--	65 (106)	--	--	76 (71)	80 (15)	--	95 (1)	--
1988	--	—	52 (1)	--	66 (402)	65 (19)	--	77 (4)	77 (117)	78 (4)	--	--	72 (1)
. 1989	--	49 (9)	55 (1)	62 (3)	66 (167)	65 (15)	—	77 (6)	77 (72)	77 (3)	--	84 (1)	
1990	--	52 (34)	47 (1)	59 (2)	68 (251)	65 (8)	--	80 (6)	78 (32)	80 (6)	--	—	--
1991	--	50 (8)	54 (3)	58 (2)	67 (97)	67 (21)	—	78 (1)	79 (28)	—	88 (1)	—	--
1992	--	54 (26)	48 (1)	76 (1)	68 (176)	--	—	74 (1)	--	--	--	--	--
1993	--	52 (18)	—	68 (11)	—	--			--	--	—	—	--
Subbasin hatchery.													
Big Creek:													
1987	--	--	--	—	—	—	--	--	76 (1)	—	--	--	
1988	--	--	—	—	73 (5)	--	--	75 (6)	--	—	--	--	
1989	--	--	—	64 (228)	--	—	--	77 (120)	—	—	—	—	
1990	--	--	--	62 (58)	65 (66)	--	--	77 (59)	76 (6)	—	—	—	
Mixed.[a]													
1991	57 (6)	—	— —	67 (13)	65 (6)	—	--	72 (2)	—	—	--	--	--
Hood River.													
1992	--	—	—	65 (71)	--	--	--	77 (15)	--	--	—	—	
1993	48 (10)	—	—	66 (232)	--	—	—	—	--	--	—	--	
1994	46 (10)	--	—	--	—	—	--	--	—	--	—	--	

[a] Returns from the 1991 brood are progeny of wild x Big Creek hatchery crosses.

Table 31. Mean weight (kg) of adult winter steelhead without spawning checks in the 1995-96 run year by origin, sex. and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	Freshwater/ocean age 1/1	1/2	113	1/4	2/1	2/2	2/3	3/1	3/2	3/3	Sample[a] mean
Natural,											
Females,											
N	--	5	1	--	4	113	19	--	9	2	155
Mean	--	3.26	3.5	--	2.05	3.23	4.84	--	3.04	4.70	3.44
STD	--	0.69	—	--	0.73	0.64	0.92	--	0.62	0.85	0.91
Range	--	2.5-4.3	3.5	--	1.3-3.0	1.5-5.0	3.8-6.7	--	2.5-4.6	4.1-5.3	1.3-6.7
Males.											
N	--	6	—	1	14	59	8	1	12	3	107
Mean	--	3.22	—	6.0	1.36	3.25	5.68	1.2	3.04	5.03	3.22
STD	--	0.74	—	—	0.43	0.74	1.67	--	0.79	1.45	1.32
Range	--	2.3-4.4	—	6.0	0.8-2.0	1.3-5.5	3.3-7.5	1.2	1.9-4.3	4.1-6.7	0.8-7.5
Total.											
N	--	11	1	1	18	172	27	1	21	5	262
Mean	--	3.24	3.5	6.0	1.51	3.24	5.09	1.2	3.04	4.90	3.35
STD	--	0.68	--	—	0.57	0.67	1.22	—	0.70	1.12	1.10
Range	--	2.3-4.4	3.5	6.0	0.8-3.0	1.3-5.5	3.3-7.5	1.2	1.9-4.6	4.1-6.7	0.8-7.5
Subbasin hatchery,											
Females,											
N	--	83	9	—	—	—	—	—	—	..	96
Mean	--	2.70	4.56	--	--	--	—	--	—	—	2.96
STD	--	0.45	0.63	--	—	—	--	—	--	—	0.70
Range	--	1.8-4.5	3.7-5.8	—	—	—	--	—	—	—	1.8-5.8
Males,											
N	10	146	5	—	—	--	—	—	—	—	165
Mean	0.97	2.92	4.94	--	—	—	--	—	—	—	2.07
STD	0.11	0.51	1.24	—	--	--	—	--	—	--	0.80
Range	0.8-1.2	1.8-4.6	3.0-5.8	—	—	--	—	—	—	--	0.8-5.8
Total.											
N	10	229	14	—	--	—	—	—	—	—	263
Mean	0.97	2.07	4.69	—	--	--	--	--	—	—	2.91
STD	0.11	0.49	0.07	—	--	--	--	--	--	—	0.77
Range	0.8-1.2	1.8-4.6	3.0-5.8	—	—	--	—	—	—	—	0.8-5.8

[a] Mean estimates include steelhead with spawning checks and steelhead in which the origin, but not the age of the fish could be determined from the scale sample.

Table 32. Mean weight (kg) of adult winter steelhead without spawning checks by origin, stock, brood year, and age category. [Sample size Is in parentheses. Sample statistics. by run year, are presented in previous tables and in Olsen et al. (1995) and Olsen et al. (1996).]

Origin, stock, brood year	Freshwater/ocean age 1/1	2/1	3/1	1/2	2/2	3/2	1/3	2/3	3/3	1/4	2/4	3/4
Wild.												
Hood River.												
1988	--	—	--	--	--	—	—	--	4.5 (2)	--	--	3.2 (1)
1989	--	--	--	—	--	2.8 (13)	--	4.8 (40)	4.6 (3)	--	6.9 (1)	--
1990	--	—	1.1 (1)	--	3.3 (215)	2.7 (8)	5.4 (4)	4.8 (32)	4.9 (5)	--	—	—
1991	—	1.3 (8)	1.4 (2)	2.4 (1)	3.1 (95)	3.0 (21)	4.7 (1)	5.1 (27)	--	6.0 (1)		
1992	--	1.6 (26)	1.2 (1)	4.6 (1)	3.2 (172)	--	3.5 (1)	--	--	—	--	--
1993	—	1.5 (18)	--	3.2 (11)	--	--	--	--	--	--		
Subbasln hatchery.												
Big Creek,												
1990	--	--	--	--	--	—	3.9 (1)	4.6 (6)	—	—	—	—
Mixed,[a]												
1991	--	—	--	2.5 (3)	3.0 (6)	--	3.8 (2)	--	--	—	--	--
Hood River,												
1992	--	—	--	2.8 (61)	--	—	4.7 (14)	--	--	—	--	—
1993	1.2 (10)	--	--	2.9 (229)	--	—	—	--	--	—	--	--
1994	1.0 (10)	--	--	—	--	—	—	--	--	—	--	--

[a] Returns from the 1991 brood are progeny of wild x Big Creek hatchery crosses.

Table 33. Adult Winter steelhead sex ratios as a percentage of females by origin, stock. run year, and age category.. Fish were sampled at the Powerdale Dam trap. (Sample size is In parentheses.)

Origin. stock. run year	Freshwater/ocean age 1/1	1/2	1/3	114	2/1	2/2	2/3	2/4	3/1	3/2	3/3	3/4	4/2	Repeat spawners
Wild,														
Hood River.														
1991-92	--	67 (3)	75 (4)	-.-	0 (9)	58 (402)	63 (71)	--	0 (1)	64 (106)	88 (16)	--	100 (1)	64 (47)
1992-93	_	50 (2)	67 (6)	--	26 (34)	63 (167)	72 (117)	0 (1)	100(1)	42 (19)	60 (15)	--	—	a7 (31)
1993-94	_	0 (2)	67 (6)	--	12 (8)	69 (251)	67 (72)	--	0 (1)	60 (15)	75 (4)	--	..	100 (11)
1994-95	--	0 (1)	100(1)	--	19 (26)	58 (97)	5.3 (32)	100 (1)	0 (3)	25 (8)	100 (3)	100(1)	--	69 (16)
1995-96	_	45 (11)	100 (1)	0 (1)	22 (18)	65 (176)	68 (28)	--	0 (1)	43 (21)	50 (6)		_	57 (7)
Subbasin hatchery,														
Big Creek,														
1991-92	--	36 (228)	100 (6)	--	--	60 (5)	100 (1)	--	—			--	--	80 (5)
1992-93	_	21 (58)	74 (120)	--	--	--	--	--	--				--	71 (7)
1993-94	--	--	66 (59)	--	..	39 (66)	--	--	--	--	--		—	50 (4)
1994-95	—	--	—	--	--	--	100 (6)	--	--	--	--		—	100(3)
Mixed,[a]														
1992-93	67 (6)	--	--	--					—			--	--	--
1993-94	--	31 (13)	--	—	--	--	--	--	—				--	--
1994-95	—	_	100 (2)	--	--	33 (6)	--	--	—	--	--	--	--	--
Hood River.														
1994-95	10 (10)	52 (71)	--	--	--	--	--	--	--	--	--		--	100(1)
1995-96	0 (10)	37 (232)	67 (15)	--	--	--	--	--	--	--	--	--	—	—

[a] Returns from the 1991 brood are progeny of wild x Big Creek stock hatchery crosses.

Table 34. Mean fecundity of adult winter steelhead by ocean age and run year. Fish were sampled at the Powerdale Dam trap.

Origin. ocean age. run year	N	Mean fork length (cm)	Fecundity (eggs/female) Mean	Range	95% C.I.
Wild.					
1 Salt,					
1995-96		58.0	2.900	2.900	--
2 Salt.					
1991-92	11	62.7	2.940	1.930 - 4.950	± 624
1992-93	8	66.7	3.620	3.036 - 4.117	± 317
1993-94	18	68.0	3.330	2.025 - 6.480	± 519
1994-95	12	66.2	3.150	1.737 - 5.016	± 611
1995-96	15	68.8'	3.558	1,904 - 5,776	± 557
3 Salt.					
1991-92	6	74.8	3.032	2.502 - 4.080	± 572
1992-93	7	77.2	4.080	2.856 - 6.398	± 1.189
1993-94	7	76.6	4.500	2.493 - 5.400	± 880
1994-95	6	74.8	4,331	3.375 - 5,472	± 840
1995-96	4	76.2	4.836	3.344 - 6,325	± 2.070
4 Salt.					
1991-92	1	78.0	3.240	3.240	--
1992-93	1	85.0	4.632	4,632	--
Subbasin hatchery.[a]					
2 Salt.					
1995-96	4	64.9	2,726	2.025 - 3,878	± 1.325

[a] Hood River stock.

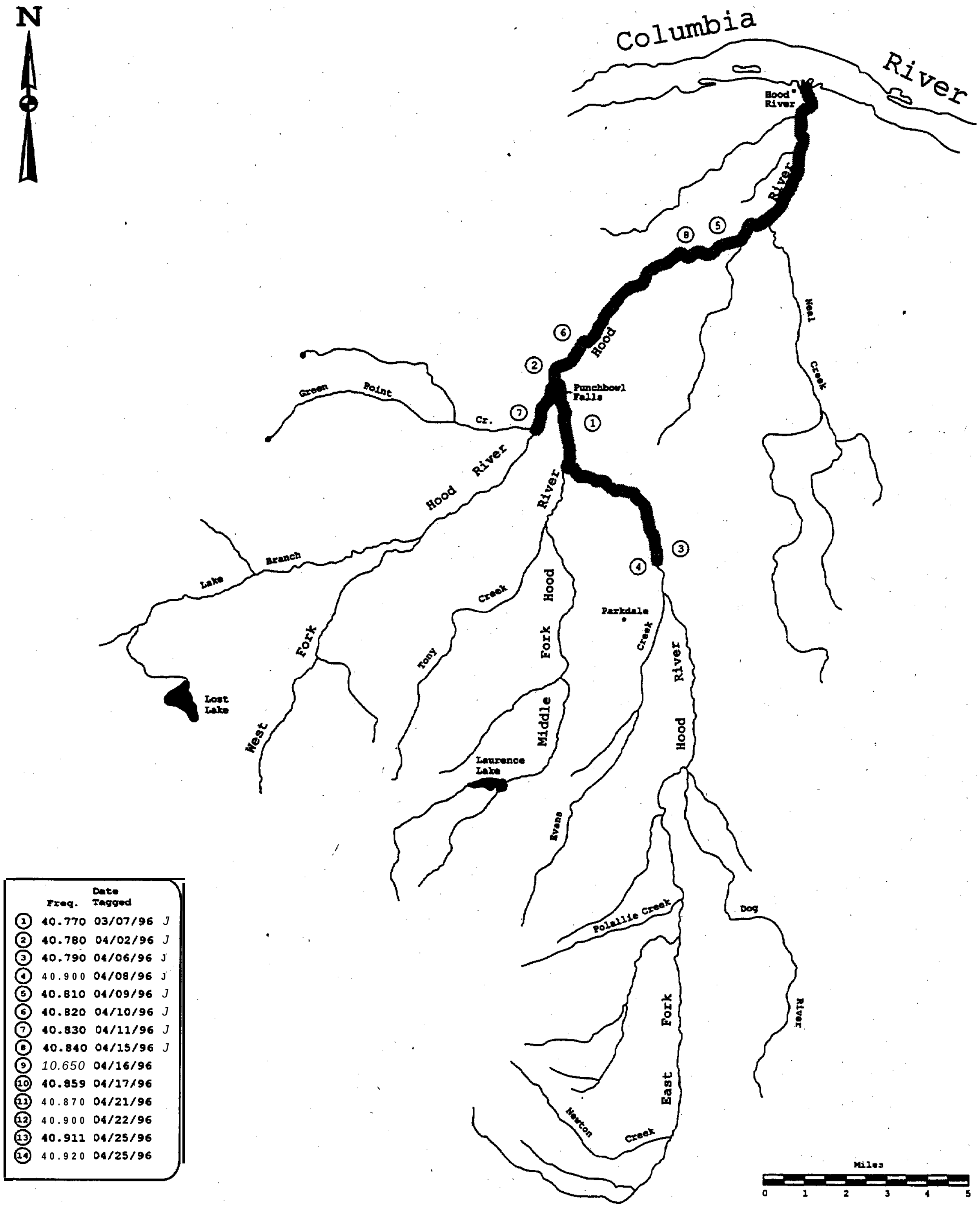

Figure 22. Maximum spatial distribution of radio-tagged wild adult winter steelhead during April 1996. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged winter steelhead are from the 1995-96 run year.

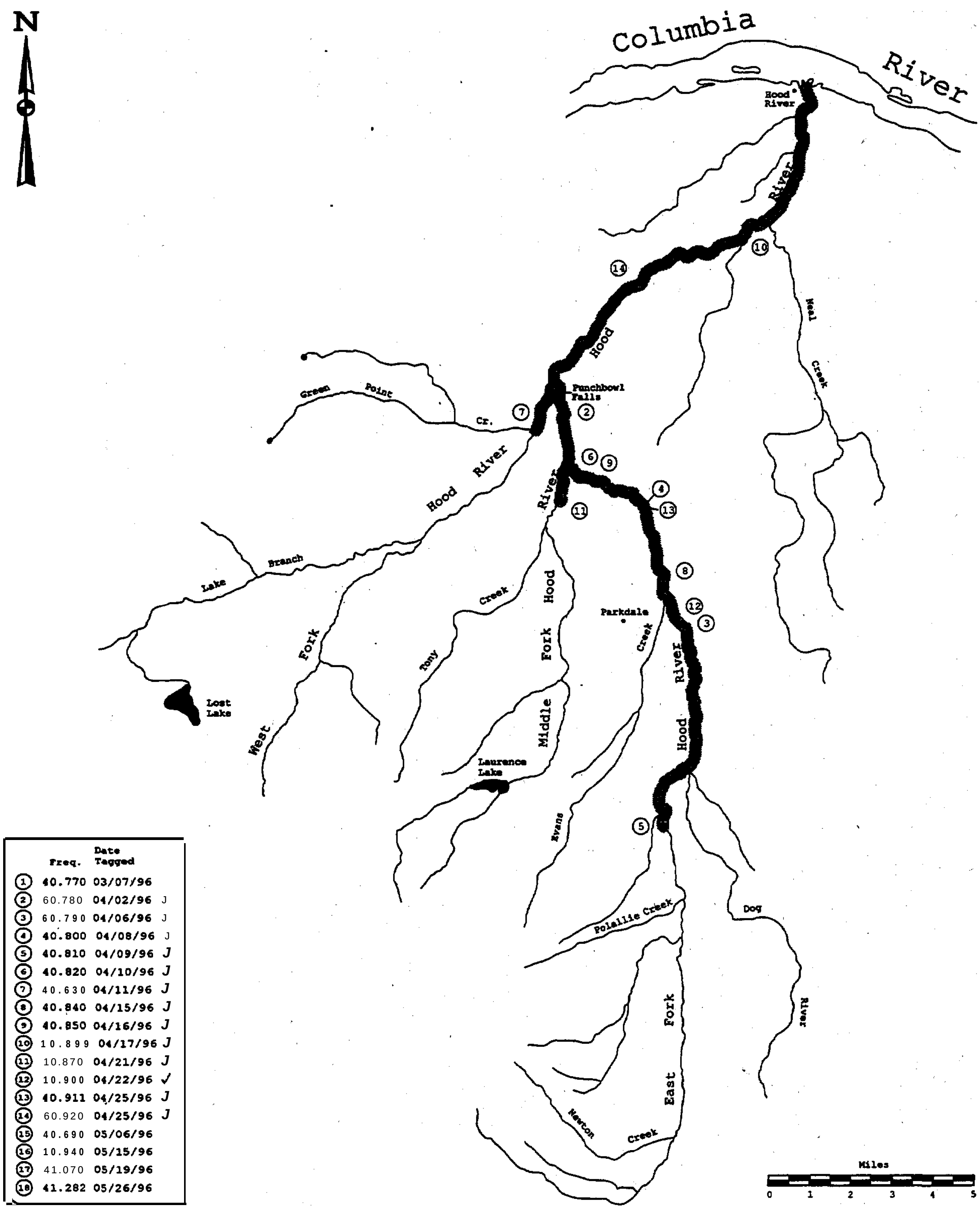

Figure 23. Maximum spatial distribution of radio-tagged wild adult winter steelhead during May 1996. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged winter steelhead are from the 1995-96 run year.

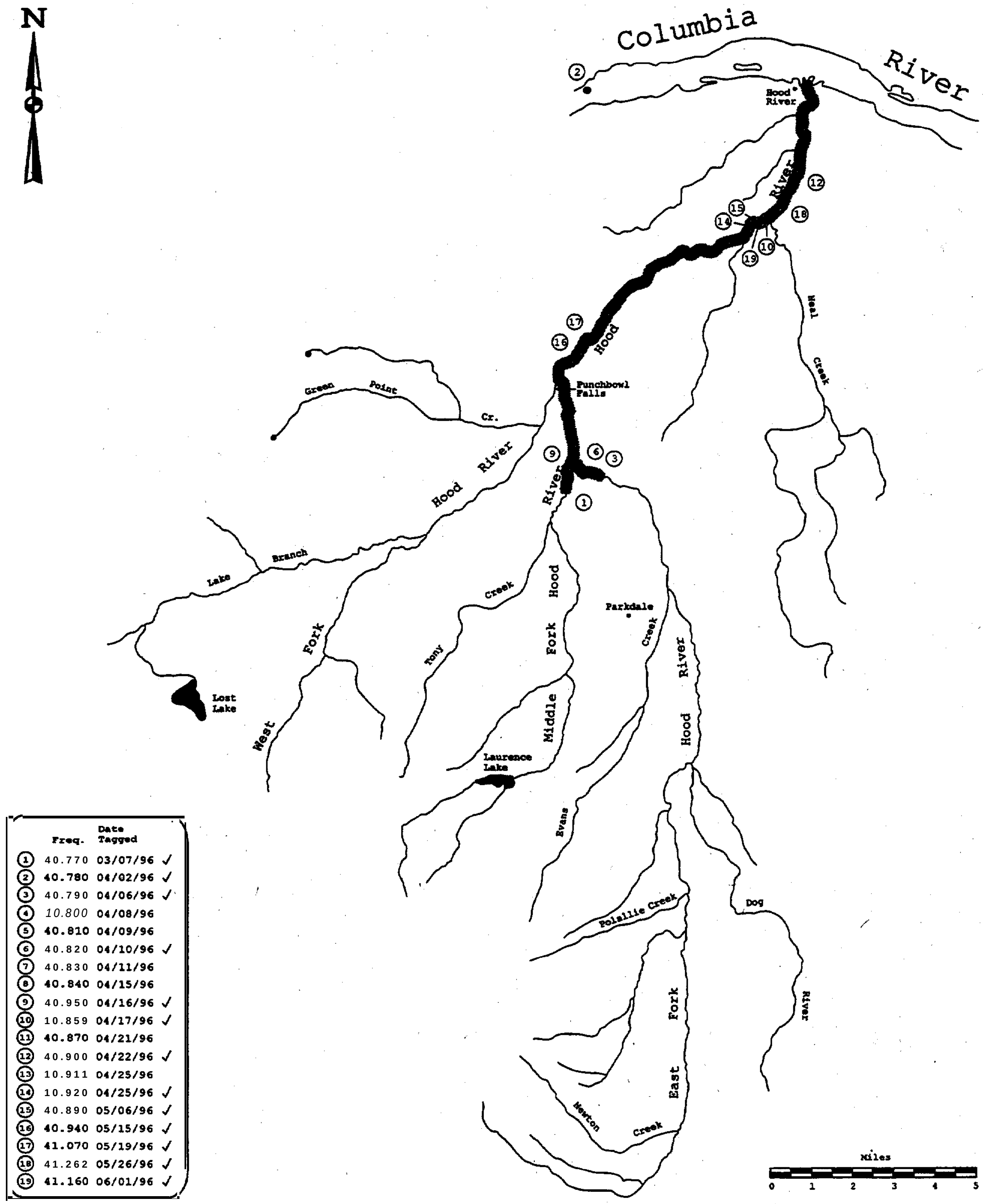

Figure 24. Maximum spatial distribution of radio-tagged wild adult winter steelhead during June 1996. Frequencies detected during the period are marked with a check ("✓"). Radio-tagged winter steelhead are from the 1995-96 run year.

Table 35. Bimonthly counts of upstream migrant jack and adult spring chinook salmon captured at the Powerdale Dam trap, by run year. Counts are boldfaced for the bimonthly period in which the median date of migration occurred in each origin category.

Origin,	April		May		June		July		August		September		October		
run year	01-15	16-30	01-15	16-31	01-15	16-30	01-15	16-31	01-15	16-31	01-15	16-30	01-15	16-31	Total
Natural,															
1992	0	**0**	1	**8**	5	11	4	4	0	0	0	1	0	0	34
1993	0	**0**	1	4	3	9	6	8	2	6	2	0	0	0	41
1994	0	**0**	1	5	0	1	3	**8**	1	2	0	12	0	0	33
1995	0	**0**	0	2	4	2	4	4	0	0	1	1	0	0	18
1996	0	**0**	1	7	50	4	9	3	8	6	1	0	0	0	**89**
Subbasin hatchery,															
1992	0	**9**	77	145	75	63	15	4	4	1	2	2	1	0	398
1993	0	**1**	25	206	89	51	51	17	5	9	5	0	0	0	459
1994	0	**6**	34	166	28	7	4	17	1	0	1	1	0	0	265
1995	0	**0**	0	6	30	10	11	**3**	0	1	1	0	0	0	62
1996	0	**0**	0	0	10	4	1	0	0	0	0	0	0	0	15
Stray hatchery.															
1992	0	0	0	0	0	0	0	**0**	1	0	0	0	0	0	1
1993	0	0	0	0	1	0	1	**0**	0	0	0	0	0	0	2
1994	0	0	0	0	0	0	1	**6**	1	2	0	0	0	0	10
1995	0	0	0	0	3	1	0	**1**	0	2	0	1	0	0	**8**
1996	0	0	0	0	8	3	4	**0**	**1**	0	1	0	0	0	17
Unknown.															
1992	0	3	5	8	3	0	0	**0**	1	0	0	0	0	0	20
1993	0	0	0	4	0	0	2	**2**	0	0	0	0	0	0	8
1994	0	0	0	0	0	1	0	**0**	0	0	0	1	0	0	2
1995	0	0	0	0	0	0	1	**0**	0	1	0	2	0	0	4
1996	0	0	0	1	1	2	1	**2**	0	3	0	0	0	0	10

Table 36. Estimated harvest of natural jack and adult spring chinook salmon in the Hood River sport fishery located from the mouth of the Hood River to 0.3 miles above Powerdale Dam (RM 4.8). 1996. Confidence limits (95%) are in parenthesis.

Period	Unmarked[a] adult spring chinook salmon		Unmarked[b] jack spring chinook salmon'		Catch Rate
	Kept	Released	Kept	Released	(hrs/fish)
Apr 16-30	--	--	--	--	--
May 1-15	4 (6.8)	--	--	--	502
May 16-31	13 (14.9)	--	7 (11.6)	--	158
Jun 1-15	9 (11.2)	--	--	--	206
Jun 16-30	3 (5.8)	--	--	--	672
Jul 1-15	4 (6.4)	--	--	--	253
Jul 16-31	10 (14.2)	--	--	--	59
Aug 1-15	--	--	--	--	--
Total	43 (26)	--	7 (12)	--	213[c]

[a] Estimates were not adjusted for unmarked stray hatchery adults. Numbers are assumed to be low based on the fact that few stray hatchery fish are caught at Powerdale Dam.

[b] Estimates were not adjusted for either unmarked stray hatchery spring chinook salmon or unmarked hatchery spring chinook salmon from the 1993 brood release. Approximately 69% of the 1993 brood was released unmarked (see HATCHERY PRODUCTION. Production Releases).

[c] Estimate is for the period 1 May - 31 July..

Table 37. Estimated harvest of subbasin hatchery jack and adult spring chinook salmon in the Hood River sport fishery located from the mouth of the Hood River to 0.3 miles above Powerdale Dam (RM 4.8). 1996. Confidence limits (95%) are in parenthesis.

Period	Subbasin hatchery adult spring chinook salmon		Subbasin hatchery jack spring chinook salmon		Catch Rate
	Kept	Released	Kept	Released	(hrs/fish)
Apr 16-30	--	--	--	--	--
May 1-15	--	--	--	--	--
May 16-31	--	--	--	--	--
Jun 1-15	5 (7.7)	--	--	--	370
Jun 16-30	--	--	--	--	--
Jul 1-15	--	--	--	--	--
Jul 16-31	--	--	--	--	--
Aug I-15	--	--	--	--	--
Total	5 (8)	--	--	--	2.127[a]

[a] Estimate is for the period 1 May - 31 July.

Table 38. Jack and adult spring chinook salmon escapements to the Powerdale Dam trap by origin, stock. run year. and age category. Fish of unknown origin were allocated to origin categories based on scale analysis and the ratio of fish of known origin (see METHODS).

Origin, stock, run year	Total escapement	Freshwater.total age									
		1.2	1.3	1.4	1.5	2.2	2.3	2.4	2.5	2.6	3.5
Natural,											
Hood River,[a]											
1992	38	0	1	24	1	0	--	9	3	0	0
1993	45	0	1	16	11	1	--	8	8	0	0
1994	34	1	2	14	5	0	--	5	6	1	0
1995	20	0	4	1	4	0	--	2	9	0	0
1996	99	1	4	7	0	0	--	85	1	0	1
Subbasin hatchery,											
Carson.											
1992	414					0	3	393	18	0	
1993	460	--				--	15	212	233	0	--
1994	261		--	--	--	--	--	245	16	0	
1995	37	--	--	--	--	--	--	--	36	1	--
Deschutes,											
1993	3	--	--	--	--	3	--	--			--
1994	5		--	--	--	b	5	--			--
1995	27		--	--	--	4	b	23	--	--	--
1996	15		--	--	--	0	15	b			--
Stray hatchery,											
Unknown,											
1992	1	--	--	1	0	0	0	0	0	--	--
1993	'2		--	2	0	0	0	0	0	--	
1994	10		--	0	0	10	0	0	0	--	
1995	8			0	0	0	3	5	0	--	--
1996	17		--	2	1	0	0	12	2	--	

[a] Developed from Deschutes and Carson stock hatchery production releases.
[b] Hatchery returns in this age category would be progeny of the 1992 brood. No hatchery fish were released into the Hood River subbasin from this brood (see HATCHERY PRODUCTION, Production Releases).

Table 39. Jack and adult spring chinook salmon escapements to the Powerdale Dam trap by origin, stock, brood year, and total age. (Percent return is in parentheses. Brood years are bold faced for those years in which brood year specific estimates of escapement are canplete. Estimates are based on returns in the 1992-96 run years.)

Origin, stock, 'brood year[a]	Smolt production	Total aoe				
		Age 2	Age 3	Age 4	Age 5	Age 6
Natural,						
Hood River,[b]						
1986	--	--	--	--	--	0
1987	--	--	--	--	4	0
1988	--	--	--	33	19	1
1989	--	--	1	24	11	0
1990	--	0	1	19	13	0
1991	--	1	2	3	2	--
1992	--	1	4	92	--	
1993	--	0	4	--	--	
1994	--	1	--	--	--	
Subbasin hatchery,						
Carson,						
1986	149.939	--	--	--	--	0
1987	134.047	--	--	--	18 (0.01)	0
1988	197.988	--	--	393 (0.20)	233 (0.12)	0
1989	125.432	--	3 (.002)	212 (0.17)	16 (0.01)	1 (.001)
1990	163.295	0	15 (.009)	245 (0.15)	-36 (0.02)	0
Deschutes.						
1991	75.205	3 (.004)	5 (.007)	23 (0.03)	--	
1992[c]	0	--	--	--	--	--
1993	170.004	4 (.002)	15 (0.01)	--	--	--
1994	123.230	0	--	--	--	--

[a] Complete brood returns are available beginning with the 1990 wild and 1989 hatchery broods. as determined based on age structure for jack and adult spring chinook salmon sampled at the Powerdale Dam trap. Estimates of escapement for prior brood years do not include returns from all possible age categories.
[b] Developed from Oeschutes and Carson stock hatchery production releases.
[c] No hatchery fish were released from the 1992 brood (see HATCHERY PRODUCTION. Production Releases).

Table 40. Age composition (percent) of jack and adult spring chinook salmon sampled at the Powerdale Dam trap by origin, stock, and run year. (Estimates in a given run year may not add to 100% due to rounding error.)

Origin, stock, run year	N	Freshwater.total age								
		1.2	1.3	1.4	1.5	2.2	2.3	2.4	2.5	2.6
Natural.										
Hood River,[a]										
1992	34	0	2.9	61.8	2.9	0	--	23.5	8.8	0
1993	41	0	2.4	36.6	24.4	2.4	--	14.6	19.5	0
i994 ,	33	3.0	6.1	42.4	15.2	0	--	15.2	15.2	3.0
1995	18	0	16.7	5.6	16.7	0	--	11.1	50.0	0
1996	89	0	4.5	6.7	0	0	--	***87.6***	1.1	0
Subbasin hatchery.										
Carson.										
1992	397	--	--	--	--	0	0.8	***95.0***	4.3	0
	455	—	—	--	--	--	3.3	46.2	50.5	0
1993 1995 1994	258	--	--	--	--	—	--	93'.8	6.2	0
	34	--	—	--	--	--	--	--	***97.1***	***2.9***
Deschutes, 1993	3	—	--	--	--	100	--	--	--	--
1994	5	--	—	--	--	***b***	100	--	--	--
1995	25	--	--	--	--	16.0	*b*	84.0	--	--
1996	15	--	--	--	--	--	100	*b*	--	--
Stray hatchery.										
Unknown.										
1992	1	—	--	100	0	0	0	*0*	0	--
1993	2	--	—	100	0	0	0	*0*	0	--
1994	10	--	--	0	0	100	0	*0*	0	--
1995	8	—	—	0	0	0	37.5	62.5	0	--
1996	17	--	--	11.8	5.9	0	0	***JO.6***	11.8	--

[a] Developed from Deschutes and Carson stock hatchery production releases.
[b] Hatchery returns in this age class would be progeny of the 1992 brood. No hatchery fish were released into the Hood River subbasin from this brood (see HATCHERY PRODUCTION. Production Releases).

Table 41. Mean fork length (cm) of jack and adult spring chinook salmon in the 1996 run year by origin. sex. and age category. Fish were sampled at the Powerdale Dam trap.

Origin. sample pop.. statistic	Freshwater.total aoe					Sample mean
	1.3	1.4	2.3	2.4	2.5	
Natural.						
Female,						
N	2	3	--	49	1	55
Mean	63.50	79.50	--	76.19	84.5	76.06
STD	2.12	3.97	--	2.60	--	3.81
Range	62.0-65.0	76.5-84.0	--	71.0-83.0	84.5	62.0-84.5
Male.						
N	2	3	--	29	--	34
Mean	60.50	84.00	--	77.28	--	76.88
STD	0.71	2.65	--	6.18	--	7.34
Range	60.0-61.0	81.0-86.0	--	63.5-93.0	--	60.0-93.0
Total.						
N	4	6	--	78	1	89
Mean	62.00	81.75	--	76.60	84.5	76.38
STD	2.16	3.90	--	4.29	--	5.41
Range	60.0-65.0	76.5-86.0	--	63.5-93.0	84.5	60.0-93.0
Subbasin hatchery.[a]						
Jacks.						
N	--	--	15	--	--	15
Mean	--		52.43	--	--	52.43
STD	--		5.14	--	--	5.14
Range	--		38.0-59.0	--	--	38.0-59.0
Total.						
N	--	--	15	--	--	15
Mean	--	--	52.43	--	--	52.43
STD	--	--	5.14	--	--	5.14
Range	--		38.0-59.0	--	--	38.0-59.0

[a] Spring chinook salmon are returns from releases of Deschutes stock hatchery spring chinook salmon.

Table 42. Mean fork length (cm) of jack and adult spring chinook salmon by origin, stock., brood year, and age category. [Sample size is in parentheses. Sample statistics. by run year, are presented in previous tables and in Olsen et al. (1995) and Olsen et al. (1996).

Origin, stock. brood year	Freshwater.total aae 1.2	1.3	1.4	1.5	2.2	2.3	2.4	2.5	2.6
Natural,									
Hood River,[a]									
1987			--	86 (1)	--	--	--	85 (3)	--
1988	--	--	81 (21)	91 (10)	--	--	72 (8)	88 (8)	92 (1)
1989	--	7i (1)	82 (15)	96 (5)	--	--	87 (6)	79 (5)	--
1990	--	70 (1)	77 (14)	92 (3)	--	--	72 (5)	95 (9)	—
1991	—	62 (2)	80 (1)	--	66 (1)	--	72 (2)	a4 (1)	--
1992	30 (1)	68 (3)	82 (6)	--	—	--	77 (78)	--	
1993	--	62 (4)	--	--	--	--	--	--	
Subbasin hatchery,									
Carson, 1987			--			--	--	89 (17)	
1988			--			--	74 (370)	89 (227)	--
	--	--				56 (3)	83 (209)	82 (16)	85 (1)
1989 1990	--	--	--	--	--	52 (15)	75 (242)	92 (33)	--
Oeschutes.									
1991				--	30 (3)	52 (5)	75 (21)	--	
1992[b]	--	--		--	--	--	—	--	
1993	--	--		--	26 (4)	52 (15)	--	--	

[a] Developed from Deschutes and Carson stock hatchery production releases.
[b] No hatchery fish were released from the 1992 brood (see HATCHERY PRODUCTION, Production Releases).

Table 43. Mean weight (kg) of jack and adult spring chinook salmon in the 1996 run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	Freshwater.total aoe 1.3	1.4	2.3	2.4	2.5	Sample mean
Natural,						
Female,						
N	2	3	--	49	1	55
Mean	3.00	6.07	--	5.48	7.7	5.46
STD	0.42	1.24	--	0.61	--	0.85
Range	2.7-3.3	5.3-7.5	--	4.5-7.2	7.7	2.7-7.7
Male,						
N	2	3	--	29	--	34
Mean	2.80	6.97	--	5.30	--	5.37
STD	0.00	0.76	--	1.20	--	1.37
Range	2.0-2.8	6.1-7.5	--	3.1-7.7	--	2.8-7.7.
Total,						
N	4	6	--	78	1	89
Mean	2.90	6.52	--	5.44	7.7	5.43
STD	0.27	1.04	--	0.87	--	1.06
Range	2.7-3.3	5.3-7.5	--	3.1-7.7	7.7	2.7-7.7
Subbasin hatchery,[a]						
Jacks,						
N	--	--	14	--	--	14
Mean	--	--	1.88	--	--	1.88
STD	--	--	0.52	--	--	0.52
Range	--	--	0.8-2.7	--	--	0.8-2.7
Total,						
N	--	--	14			14
Mean	--	--	1.88	--	--	1.88
STD	--	--	0.52			0.52
Range	--	--	0.8-2.7	--	--	0.8-2.7

[a] Spring chinook salmon are returns from releases of Deschutes stock hatchery spring chinook salmon.

Table 44. Mean weight (kg) of jack and adult spring chinook salmon by origin, stock, brood year, and age category. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables and in Olsen et al. (1995) and Olsen et al. (1996).]

Origin, stock, brood year	Freshwater.total age								
	1.2	1.3	1.4	1.5	2.2	2.3	2.4	2.5	2.6
Natural,									
Hood River,[a]									
1988	--	--	--	--	--	--	--	--	9.5 (1)
1989	--	--	--	10.1 (5)	--	--	--	6.2 (5)	--
1990	--	--	5.4 (13)	9.4 (3)	--	--	4.9 (5)	9.3 (9)	--
1991	--	2.9 (2)	5.7 (1)	--	--	--	4.6 (2)	7.7 (1)	--
1992	0.3 (1)	4.2 (3)	6.5 (6)	--	--	--	5.4 (78)	--	--
1993	--	2.9 (4)	--	--	--	--	--	—	--
Subbasin hatchery.									
	--	--				--	--	6.7 (16)	7.4 (1)
Carson. 1989 1990	--	--	--	--	--	--	5.3 (235)	8.5 (31)	--
Deschutes.									
1991	--	--	--	--	--	1.6 (5)	4.9 (19)	--	--
1992[b]	--	--	--	--	--	--	--	--	--
1993	--	--	--	--	0.3 (1)	1.9 (14)	--	--	--

[a] Developed from Deschutes and Carson stock hatchery production releases.
[b] No hatchery fish were released from the 1992 brood (see HATCHERY PRODUCTION. Production Releases).

Table 45. Jack and adult spring chinook salmon sex ratios as a percentage of females by origin, stock. run year, and age category. Fish were sampled at the Powerdale Dam trap. (Sample size is in parentheses.)

Origin, stock. run year	Freshwater.total ase								
	1.2	1.3	1.4	1.5	2.2	2.3	2.4	2.5	2.6
Natural.									
Hood River,[a]									
1992	--	0 (1)	67 (21)	100 (1)	--	--	25 (8)	67 (3)	--
1993	--	0 (1)	73 (15)	80 (10)	0 (1)	--	67 (6)	50 (8)	--
1994	0 (1)	0 (2)[b]	36 (14)	60 (5)	--	--	60 (5)	40 (5)	100 (1)
1995	--	100 (3)[b]	0 (1)	67 (3)	--	-e	100 (2)	67 (9)	--
1996	--	50 (4)[b]	50 (6)	--	--	—	63 (78)	100 (1)	--
Subbasin hatchery.									
Carson.									
1992	--	--	--	--	--	0 (3)	74 (370)	71 (17)	--
1993	--	--	m-	--	--	47 (15)[b]	71 (209)	61 (227)	--
1994	--	--	--	--	--	--	64 (242)	62 (16)	--
1995	--	--	--	--	--	—	--	64 (33)	0 (1)
Deschutes.									
1993	--	--	—	--	0c (3)	--	--	--	--
1994	--	--	--	--	0 (4)	40 (5)[b]	--	—	--
1995	--	--	--	--		c	81 (21)	--	--
1996	--	--	--	--	--	0 (15)	c	--	--

[a] Developed from Deschutes and Carson stock hatchery production releases.
[b] Jacks were classified as females based on visual observation.
[c] Hatchery returns in this age class would be progeny of the 1992 brood. No hatchery fish were released into the Hood River subbasin from this brood (see HATCHERY PRODUCTION, Production Releases).

Table 46. Bimonthly counts of upstream migrant jack and adult fall chinook salmon captured at the Powerdale Dam trap. by origin and run year. Counts are boldfaced for the bimonthly period in which the median date of migration occurred in each origin category.

Origin. run year	July 01-15	July 16-31	August 01-15	August 16-31	September 01-15	September 16-30	October 01-15	October 16-31	November 01-15	November 16-30	December 01-15	December 16-31	Total
Natural.													
1992	0	0	4	**1**	2	7	1	1	0	0	0	0	16
1993	0	0	3	1	2	0	0	0	0	0	0	0	6
1994[a]	0	6	2	0	0	**13**	3	1	0	0	0	0	25
1995[b]	0	4	0	**1**	3	0	0	0	0	0	0	0	8
1996	1	1	0	7	3	0	0	1	0	0	D	D	13
Stray hatchery.													
1992	0	0	0	0	2	**1**	2	1	0	0	0	0	6
1993	0	0	0	0	2	**1**	1	0	0	0	0	0	4
1994[a]	0	0	0	0	0	**6**	1 •	0	0	0	0	0	7
1995b	0	0	0	0	2	**2**	0	0	0	0	0	0	4
1996	0	0	0	0	1	**0**	1	0	0	0	D	0	2
Unknown.													
1992	--	--	--	--	--					—	--	--	0
1993	—	--	--	--	--	--	--	--	--	--	--	—	0
1994[a]	0	0	0	0	D	3	2	**1**	1	0	0	0	7
1995b	—	--	--	--	--	—	--	—	—	—	--	--	0
19%	0	0	0	0	1	0	0	0	0	0	0	0	1

[a] Trap was inoperable from 10/27-11/07/94 because of flood damage:

b Powerdale Dam trap was inoperative from 11-13 Nov 1995 and from 20-24 Nov 1995 because of flood damage and from 28 Nov 1995 - 27 Feb 1996 for modifications to the adult fish ladder.

Table 47. Estimated harvest of unmarked and stray hatchery jack and adult fall chinook salmon in the Hood River sport fishery located from the mouth of the Hood River to 0.3 miles above Powerdale Dam (RM 4.8). 1996. Estimates of harvest are combined for jack and adult flsh. Confidence limits (95%) are in parenthesis.

Period	Unmarked fall chinook salmon		Stray fall chinook salmon		Catch Rate
	Kept	Released	Kept	Released	(hrs/fish)
Dct 1-15	--	--	--	—	--
Oct 16-31	4 (8.3)	4 (7.6)	--	—	23
Nov 1-15	22 (19.9)	8 (6.2)	--	--	11
Nov 16-30	—	6 (10.9)	--	--	38
Dec 1-15	--	--	--	--	--
Total	26 (22)	18 (15)	--	--	17[a]

[a] Estimate is for the period 16 October - 30 November.

Table 48. Jack and adult fall chinook salmon escapements to the Powerdale Dam trap by **origin**, run year, and age category. Fish of unknown origin were allocated to origin categories based on scale analysis, size. and the ratio of fish of known origin (see **METHODS**).

Origin, run year	Total escapement	Freshwater.total age								
		1.2	1.3	1.4	1.5	1.6	2.3	2.4	2.5	2.6
Natural,										
1992	16	2	2	10	1	1	0	0	0	--
1993	6	0	1	3	2	0	0	0	0	--
1994	32	2	4	19	2	0	1	2	2	--
1995	8	1	0	1	1	0	1	2	2	--
1996	14	0	1	10	0	0	1	2	0	--
Stray hatchery.										
1992	6	1	3	2	0	--	0	0	--	--
1993	4	0	1	2	1	--	0	0	--	--
1994	7	0	0	5	0	--	0	2	--	--
1995	4	0	0	1	0	--	0	3	--	--
1996	2	0	0	0	0	--	1	1	--	--

Table 49. Age composition (percent) of jack and adult fall chinook salmon sampled at the Power-dale Dam trap by origin and run year. (Estimates in a given run year may not add to 100% due to rounding error.)

Origin, run year	N	Freshwater.total ase 1.2	1.3	1.4	1.5	1.6	2.3	2.4	2.5	2.6
Natural,										
1992	16	12.5	12.5	62.5	6.2	6.2	0	0	0	--
1993	6	0	16.7	50.0	33.3	0	0	'0	0	--
1994	25	8.0	16.0	48.0	8.0	0	4.0	8.0	8.0	--
1995	8	12.5	0	12.5	12.5	0	12.5	25.0	25.0	--
1996	13	0	7.7	89.2	0	0	7.7	15.4	0	--
Stray hatchery,										
1992	5	20.0	40.0	40.0	0	--	0	0	_	--
1993	4	0	25.0	50.0	25.0	--	0	0	--	--
1994	6	0	0	66.7	0	_	0	33.3	--	--
1995	4	0	0	25.0	0	_	0	75.0	_	_
1996	2	0	0	0	0	_	50.0	50.0	--	--

Table 50. Mean fork length tan) of jack and adult fall chinook salmon In the 19% run year by origin, sex. and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop.., statistic	Freshwater.total aae 1.3	1.4	2.3	2.4	Sample[a] mean
Natural.					
Jacks,					
N	--	--	1	--	1
Mean	--	--	68.0	—	68.0
STD	--	--	--	--	--
Range	--		68.0	--	68.0
Females.					
N	--	3	--	1	4
Mean	--	82.50	—	85.5	83.25
STD	--	7.57	—	--	6.36
Range		74.0-88.5	--	85.5	74.0-88.5
Males,					
N	1	6	--	--	7
Mean	62.0	81.83	--	—	79.00
STD	--	12.75	--	—	13.84
Range	62.0	64.0-98.5	--	--	62.0-98.5
Total.					
N	1	9	1	1	13
Mean .	62.0	82.06	68.0	85.5	79.27
STD	--	10.77	--	—	11.07
Range	62.0	64.0-98.5	68.0	85.5	62.0-98.5
Stray hatchery.					
Jacks,					
N	--	--	1	--	1
Mean	--	--	60.0	--	60.0
STD	--	--	—	—	--
Range	--	--	60.0	—	60.0
Females,					
N			—	1	1
Mean	--	--	—	82.0	82.0
STD	--	--	--	--	--
Range	--	--	--	82.0	82.0
Males,					
N			--	--	0
Mean	--	--	--	--	--
STD	--	--	--	--	--
Range	--	--	--	--	
Total,					
N	--	--	1	1	2
Mean	--	--	60.0	82.0	71.00
STD	--	--	--	--	15.56
Range	--	--	60.0	82.0	60.0-82.0

[a] Mean estimates include jack and adult fall chinook salmon in which the origin. but not the age of the fish could be determined from the scale sample.

Table 51. Mean fork length (cm) of jack and adult fall chinook salmon by origin, brood year, and age category. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables and in Olsen et al. (1996).]

Origin, brood year	Freshwater.total age								
	1.2	1.3	1.4	1.5	1.6	2.3	2.4	2.5	2.6
Natural,									
1986	--	--	--	--	86 (1)	--	--	--	--
1987	--	--	--	96 (1)	--	--	--	--	--
1988	—	--	83 (10)	90 (2)	--	--	--	--	--
1989	--	66 (2)	79 (3)	91 (2)	--	--	--	83 (2)	--
1990	42 (2)	52 (1)	82 (12)	89 (1)	--	--	82 (2)	90 (2)	--
1991	--	68 (4)	89 (1)	--	--	57 (1)	79 (2)	--	—
1992	53 (2)	--	82 (9)	--	--	62 (1)	86 (1)	--	--
1993	47 (1)	62 (1)	--	--	--	68 (1)	--	--	--
Stray hatchery,									
1988	--	—	--	--	--	--	--	--	--
1989	--	64 (2)	78 (2)	76 (1)	--	--	--	--	—
1990	44 (1)	70 (1)	71 (4)	--	--	--	78 (2)	--	--
1991	--	--	72 (1)	--	--	--	78 (3)	--	--
1992	--	--	--	--	--	--	82 (1)	--	--
1993	--	--	--	--	--	60 (1)	—	--	--

Table 52. Mean weight (kg) of jack and adult fall chinook salmon in the 1996 run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	Freshwater.total age 1.3	1.4	2.3	2.4	Sample[a] mean
Natural,					
Jacks,					
N	--	--	1	--	1
Mean	--	--	3.7	--	3.7
STD	--	--		--	--
Range	--	--	3.7	--	3.7
Females,					
N	--	3	--	1	4
Mean	--	7.97	--	7.1	7.75
STD	--	2.50	--	--	2.09
Range	--	5.5-10.5	--	7.1	5.5-10.5
Males.					
N	1	6	--	--	7
Mean	3.2	6.70	--	--	6.20
STD	--	2.95	--	--	3.00
Range	3.2	3.2-10.4	--	--	3.2-10.4
Total.					
N	1	9	1	1	13
Mean	3.2	7.12	3.7	7.1	6.36
STD	—	2.72	--	--	2.66
Range	3.2	3.2-10.5	3.7	7.1	3.2-10.5
Stray hatchery.					
Jacks.					
N	—	--	1	--	1
Mean	--	--	2.9	--	2.9
STD	—	--	--	--	--
Range	--	--	2.9	--	2.9
Females.					
N	--	--	--	1	1
Mean	--	--	--	6.9	6.9
STD	--	--	--	--	--
Range	—	—	--	6.9	6.9
Males,					
N	--	--	--	--	0
Mean	--	--	--	--	--
STD	--	--	--	--	--
Range	--	--	--	--	--
Total.					
N	--	--	1	1	2
Mean	--	—	2.9	6.9	4.90
STD	--	--	--	--	2.83
Range	--	--	2.9	6.9	2.9-6.9

[a] Mean estimates include jack and adult fall chinook salmon in which the origin. but not the age of the fish could be determined from the scale sample.

Table 53. Mean weight (kg) of jack and adult fall chinook salmon by origin, brood year, and age category. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables and in Olsen et al. (1996).]

Origin, brood year	Freshwater.total age								
	1.2	1.3	1.4	1.5	1.6	2.3	2.4	2.5	2.6
Natural,									
1989	--	--	--	9.5 (2)	--	--	--	7.4 (2)	--
1990	--	--	7.0 (12)	9.1 (1)	--	--	6.8 (2)	9.7 (2)	--
1991	--	4.2 (4)	8.9 (1)	--	--	2.5 (1)	5.9 (2)	--	--
1992	2.0 (2)	--	7.1 (9)	--	--	2.9 (1)	7.1 (1)	--	--
1993	1.4 (1)	3.2 (1)	--	--	--	3.7 (1)	--	--	--
Stray hatchery.									
1990	--	--	6.8 (4)	--	--	--	6.4 (2)	--	--
1991	--	--	5.1 (1)	--	--	--	5.9 (3)	--	--
1992	--	--	--	--	--	--	6.9 (1)	--	--
1993		--	--		--	2.9 (1)	--	--	--

Table 54. Jack and adult fall chinook salmon sex ratios as a percentage of females by origin, run year, and age category. Fish were sampled at the Powerdale Dam trap. (Sample size is in parentheses.)

Origin, run year	Freshwater.total age 1.2	1.3	1.4	1.5	1.6	2.3	2.4	2.5	2.6
Natural,									
1992	0 (2)	100 (2)[a]	50 (10)	0 (1)	100 (1)	--	--	--	_
1993	--	0 (1)	100 (3)	100 (2)	--	--	_	_	_
1994	0 (2)	75 (4)[a]	67 (12)	100 (2)	--	0 (1)	100 (2)	100 (2)	--
1995	0 (1)	--	100 (1)	100 (1)	--	100 (1)[a]	50 (2)	0 (2)	--
1996	_	0 (1)	33 (9)	--	-_	0 (1)	100 (1)	--	_
Stray hatchery,									
1992	100 (1)[a]	100 (2)[a]	100 (2)	--	--	_	--	_	--
1993	--	0 (1)	50 (2)	100 (1)	--	_-	--	--	--
1994	--	--	100 ([illegible])	--	--	--	100 ([illegible])	--	-_
1995	--	--	100 (1)	--	--	--	67 (3)	--	-_
1996	--	--	_	--	--	0 (1)	100 (1)	--	_

[a] Jacks were classified as females based on visual observation.

Table 55. Bimonthly counts of upstream migrant jack and adult coho salmon captured at the Powerdale Dam trap, by origin and run year. Counts are boldfaced for the bimonthly period in which the median date of migration occurred in each origin category.

Origin, run year	August 01-15	August 16-31	September 01-15	September 16-30	October 01-15	October 16-31	November 01-15	November 16-30	December 01-15	December 16-31	Total
Natural,											
1992	0	0	1	11	5	4	1	0	0	0	22
1993	0	0	0	0	0	0	0	0	0	0	0
1994[a]	0	0	0	0	1	0	0	0	0	0	1
1995[b]	0	0	3	1	4	3	0	0	0	0	11
19%	0	0	0	1	4	1	0	0	0	0	6
Stray hatchery,											
1992	0	1	6	37	12	12	11	0	0	0	79
1993	0	0	0	3	10	10'	0	3	2	0	28
1994[a]	0	0	3	15	11	23	0	0	0	0	52
1995[b]	0	1	0	12	15	11	0	0	0	0	39
19%	0	0	0	3	-12	5	0	0	0	0	20
Unknown,											
1992	0	0	0	1	0	1	0	0	0	0	2
1993	0	1	2	1	0	0	0	0	1	0	5
1994[a]	0	0	1	0	0	2	0	0	0	0	3
1995[b]	0	0	0	0	1	0	0	0	0	0	1
1996	0	0	0	0	1	0	0	0	0	0	1

[a] Trap was inoperable from 10/27-11/07/94 because of flood damage.

b Powerdale Dam trap was inoperative from 11-13 Nov 1995 and from 20-24 Nov 1995 because of flood damage and from 28 Nov 1995 - 27 Feb 19% for modifications to the adult fish ladder.

Table 56. Jack and adult coho salmon escapements to the Powerdale Dam trap by origin, run year, and age category. Fish of unknown origin were allocated to origin categories based on scale analysis and the ratio of fish of known origin (see METHODS).

Origin, run year	Total escapement	Freshwater.total age 2.2	2.3	3.4
Natural,				
1992	24	--	24	0
1993	0	--	0	0
1994	2	--	2	0
1995	12	--	11	1
1996	7		7	0
Stray hatchery,				
1992	79	13	66	--
1993	33	0	33	--
1994	54	3	51	--
1995	39	4	35	--
1996	20	1	19	--

Table.57. Age canposition (percent) of jack and adult coho salmon sampled at the Powerdale Dam trap by origin and run year.

Origin, run year	N	Freshwater.total age 2.2	2.3	3.4
Natural,				
1992	22	--	100	0
1993	0	--	--	0
1994	1	--	100	0
1995	11	--	90.9	9.1
1996	6		100	0
Stray hatchery,				
1992	79	16.5	83.5	--
1993	28	0	100	--
1994	52	5.8	94.2	--
1995	39	10.3	89.7	--
1996	20	5.0	95.0	--

Table 58. Mean fork length (cm) of jack and adult coho salmon in the 19% run year by origin, sex, and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop., statistic	Freshwater.total aae 2.2	2.3	Sample mean
Natural.			
Female.			
N	--	2	2
Mean	--	70.25	70.25
STD	--	5.30	5.30
Range	--	66.5-74.0	66.5-74.0
Male,			
N	--	4	4
Mean	--	70.62	70.62
STD	--	6.01	6.01
Range	--	66.5-79.5	66.5-79.5
Total.			
N	--	6	6
Mean	--	70.50	70.50
STD	--	5.22	5.22
Range	--	66.5-79.5	66.5-79.5
Stray hatchery.			
Jacks,			
N	1		1
Mean	36.5		36.5
STD	—		--
Range	36.5	--	36.5
Female.			
N	--	11	11
Mean	--	69.23	69.23
STD	--	4.88	4.88
Range		60.0-74.5	60.0-74.5
Male.			
N	--	8	8
Mean		73.62	73.62
STD	--	5.10	5.10
Range		65.0-79.5	65.0-79.5
Total,			
N	1	19	20
Mean	36.5	71.08	69.35
STD	--	5.32	9.30
Range	36.5	60.0-79.5	36.5-79.5

Table 59. Mean fork length (cm) of jack and adult coho salmon by origin, brood year. and age category. Fish were sampled at the Power-dale Dam trap. [Sample size is in parentheses. Sample statistics. by run year. are presented in previous tables. Olsen et al. (1994). Olsen et al. (1995). and Olsen et al. (1996).]

Origin, brood year	Freshwater.total age 2.2	2.3	3.4
Natural,			
1989		58 (22)	--
1990	--	--	--
1991		56 (1)	60 (1)
1992		65 (10)	--
1993		70 (6)	--
Stray hatchery.			
1989	--	58 (66)	--
1990	38 (13)	65 (28)	--
1991		69 (49)	--
1992	39 (3)	68 (34)	--
1993	40 (4)	71 (19)	--
1994	36 (1)	--	--

Table 60. Mean weight (gm) of jack and adult coho salmon in the 1996 run year by origin, sex. and age category. Fish were sampled at the Powerdale Dam trap.

Origin, sample pop.. statistic	Freshwater.total aae 2.2	2.3	Sample mean
Natural.			
Female,			
N	--	2	2
Mean	--	3.95	3.95
STD	--	1.34	1.34
Range		3.0-4.9	3.0-4.9
Male,			
N	--	4	4
Mean		3.85	3.85
STD		1 . 1 2	1.12
Range	--	3.0-5.5	3.0-5.5
Total,			
N	--	6	6
Mean	--	3.88	3.88
STD	--	1.06	1.06
Range		3.0-5.5	3.0-5.5
Stray hatchery.			
Jacks.			
N	1		1
Mean	0.5	--	0.5
STD	—		--
Range	0.5		a.5
Female.			
N		11	11
Mean	--	3.90	3.90
STD		0.80	0.80
Range		2.1-4.8	2.1-4.8
Hale.			
N	--	8	8
Mean		4.41	4.41
STD	--	1.02	1.02
Range	--	2.8-5.7	2.8-5.7
Total.			
N	1	19	20
Mean	0.5	4.12,	3.94
STD	--	0.91	1.20
Range	0.5	2.1-5.7	0.5-5.7

Table 61. Mean weight (kg) of jack and adult coho salmon by origin, brood year. and age category. Fish were sampled at the Powerdale Dam trap. [Sample size is in parentheses. Sample statistics, by run year, are presented in previous tables and in Olsen et al. (1995) and Olsen et al. (1996).]

Origin, brood year	Freshwater.total aoe 2.2	2.3	3.4
Natural,			
1989	--	--	--
1990	--	--	--
1991	--	1.8 (1)	2.7 (1)
1992	--	3.3 (10)	--
1993	--	3.9 (6)	--
Stray hatchery.			
1989	--	--	--
1990	--	--	--
1991'	--	3.7 (49)	--
1992	0.7 (3)	3.5 (34)	--
1993	0.8 (4)	4.1 (19)	--
1994	0.5 (1)	--	_

Table 62. Jack and adult coho salmon sex ratios as a percentage of females by origin, run year, and age category. Fish were sampled at the Powerdale Dam trap. (Sample size is in parentheses.1

Origin. run year	Freshwater.total aoe 2.2	2.3	3.4
Natural.			
1992	--	64 (22)	--
1993	--	--	--
1994	--	0 (1)	--
1995	--	50 (10)	100 (1)
1996	--	33 (6)	--
Stray hatchery.			
1992	62 (13)[a]	36 (66)	--
1993	--	21 (28)	--
1994	33 (3)[a]	43 (49)	--
1995	0 (4)	21 (34)	--
1996	0 (1)	58 (19)	--

[a] Jacks were classified as females based on visual observation.

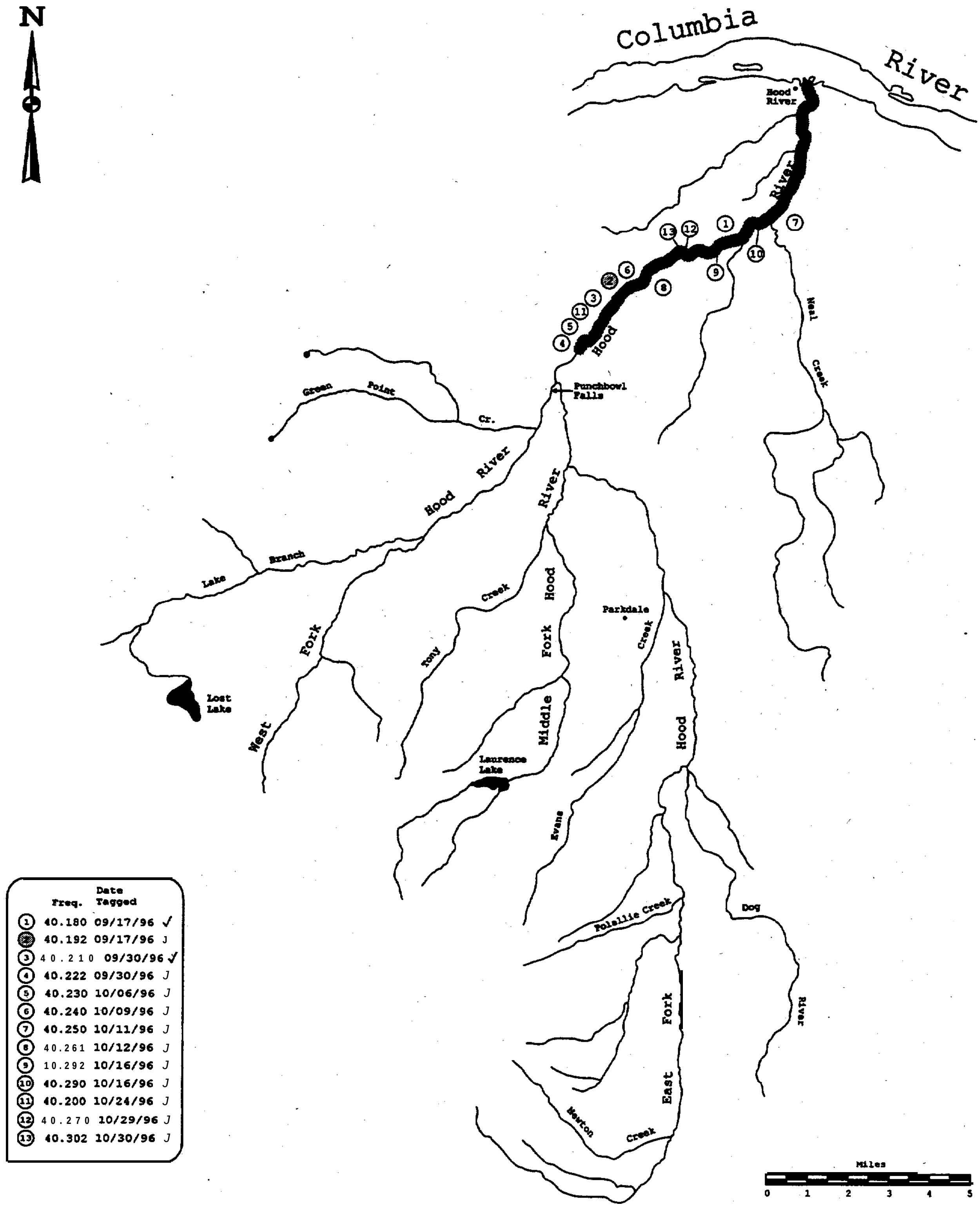

Figure 25. Maximum spatial distribution of radio-tagged natural and hatchery adult coho salmon during October 1996. Frequencies detected during the period are marked with a check ("✓"). Highlighted numbers signify naturally produced coho salmon.

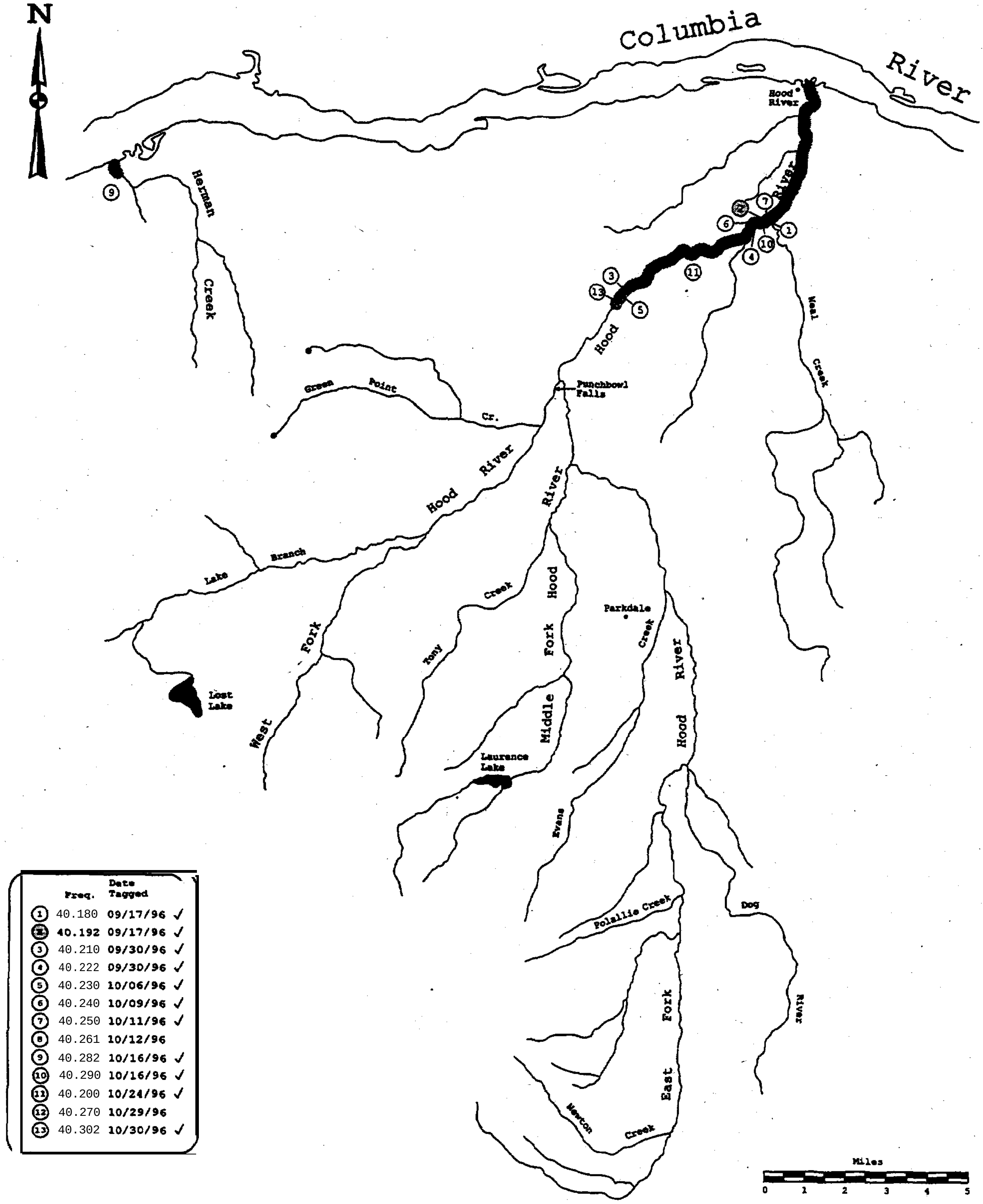

Figure 26. Maximum spatial distribution of radio-tagged natural and hatchery adult coho salmon during November 1996. Frequencies detected during the period are marked with a check ("✓"). Highlighted numbers signify naturally produced coho salmon.

Table 63. Summary of winter steelhead broodstock collection and egg take in the Hood River subbasin. With the exception of the 1990-91 run year. all hatchery broodstock was collected from the wild component of the adult winter steelhead run escaping to the Powerdale Dam trap.

Run year	Number of females	Nunber of males	Family groups	Number of spawnings	Total[a] egg take	Number of smolts	Egg to smolt survival
1990-91[b]	3	1	3	2	11.858	4.595	38.8%
1991-92	18	21	57	.6	50.748	48.985	96.5%
1992-93	16	18	78	6	62.150	38.034	61.2X
1993-94	26	28	70	8	95.043	42.860	45.1%
1994-95	18	19	47	8	63.790	50.8%	79.8%
1995-96	25	29	60	10	85,497	--	--

[a] Green egg take.
[b] Hatchery broodstock was collected from both wild and Big creek stocks of adult winter steelhead.

Table 64. Hatchery juvenile summer steelhead releases in the Hood River subbasin by brood year[a].

Broodstock, hatchery, brood year	Fin clip[b] or coded wire tag	Survival rate (%)	Date(s) released	Fish/lb	Number released	Release location
Foster,[c]						
Oak Springs,						
1987	Ad	--	04/08/88	4.4	5.830	Hood River
1987	Ad	--	04/11/88	4.6	6.026	Hood River
1987	Ad	--	04/04-05/88	4.7	17.249	Hood River
1987	Ad	--	04/08/88	4.4	5.500	West Fork Hood River
1987	Ad	--	04/04/88	4.5	5.400	West Fork Hood River
1987	Ad	--	04/06/88	4.6	10.324	West Fork Hood River
1987	Ad	--	04/04-05/88	4.7	17.188	West Fork Hood River
1987	Ad	--	04/07/88	5.0	12.350	West Fork Hood River
1988	Ad	--	04/07/89	5.3	12.826	Hood River
1988	Ad	--	04/11/89	5.5	13.630	Hood River
1988	Ad	--	05/02-03/89	4.3	10.213	West Fork Hood River
1988	Ad	--	04/10/89	5.3	19.504	West Fork Hood River
1988	Ad	--	04/06-12/89	5.5	32.853	West Fork Hood River
1989	Ad	--	04/04/90	5.3	4.876	Hood River
1989	Ad	--	04/11/90	6.5	10.660	Hood River
1989	Ad	--	04/04-05/90	5.3	25.422	West Fork Hood River
1989	Ad	--	04/03/90	5.4	5.940	West Fork Hood River
1989	Ad	--	04/03-09/90	5.5	20.306	West Fork Hood River
1989	Ad	--	04/06/90	5.7	14.591	West Fork Hood River
1990	Ad	--	04/29/91	5.4	7.020	Hood River
1990	Ad	--	04/30/91	5.5	14.743	Hood River
1990	Ad	--	04/24/91	5.8	7.013	Hood River
1990	Ad	--	04/22/91	5.2	12.787	West Fork Hood River
1990	Ad	--	04/23/91	5.3	6,943	West Fork Hood River
1990	Ad	--	04/24/91	5.5	6,869	West Fork Hood River
1990	Ad	--	04/23/91	5.6	6.776	West Fork Hood River
1990	Ad	--	04/23/91	5.8	14.981	West Fork Hood River
1991	Ad	--	04/08/92	4.8	5.880	Hood River
1991	Ad	--	04/07/92	5.2	12.870	Hood River
1991	Ad	--	04/06/92	5.4	13.365	Hood River
1991	Ad	--	04/08/92	5.5	6,958	Hood River
1991	Ad	--	04/07/92	4.7	15.082	West Fork Hood River
1991	Ad	--	04/07/92	5.2	15.023	West Fork Hood River
1991	Ad	--	04/06/92	5.4	13.750	West Fork Hood River
1991	Ad	--	04/08/92	5.5	17,045	West Fork Hood River
1992	Ad	--	04/07-08/93	6.0	33,570	West Fork Hood River
1992	Ad	--	05/04/93	6.3	17,955	West Fork Hood River
1992	Ad	--	05/05/93	6.5	19.403	West Fork Hood River

Table 64. Continued.

Broodstock. hatchery. brood year	Fin clip[b] or coded wire tag	Survival rate (%)	Date(s) released	Fish/lb	Number released	Release location
Foster.[c] (cont.)						
Oak Springs,						
1993	Ad	--	03/29-31/94	4.6	71.760	West Fork Hood River'
1993 .	Ad	--	03/29/94	4.8	5.880	West Fork Hood River
1993	Ad	--	03/30-31/94	5.2	12.402	West Fork Hood River
1994	Ad	--	04/11/95	4.6	13.600	West Fork Hood River
1994	Ad	--	04/10-11/95	5.3	46,232	West Fork Hood River
1994	Ad	--	04/12/95	5.5	16.498	West Fork Hood River
1995	Ad	--	04/01-11/96	5.2	48.346	West Fork Hood River
1995	Ad	--	04/03/96	5.5	15.017	West Fork Hood River
1995	Ad	--	04/11-12/96	5.9	5.015	West Fork Hood River

[a] Production releases prior to the 1987 brood are in Oregon Department of Fish and Wildlife and Confederated Tribes of the Warms Springs Reservation of Oregon (1990).
[b] Ad = Adipose.
[c] The Foster stock was developed from the Skamania stock of summer steelhead.

Table 65. Hatchery juvenile winter steelhead releases in the Hood River subbasin by brood year[a].

Broodstock. hatchery. brood year	Fin clip[b] or coded wire tag	Survival rate (%)	Date(s) released	Fish/lb	Number released	Release location
Big Creek,						
Trojan Ponds,						
1988	No mark	--	04/17/89	4.2	4.890	East Fork Hood River
1989	Ad	--	04/12/90	4.7	4,253	Middle Fork Hood River
1969	Ad	--	04/12/90	4.7	7.755	East Fork Hood River
Gnat Creek.						
1987	No mark	--	04/22/88	5.6	28.000	MFk Hood River
1989	Ad	--	05/09/90	5.4	12.015	Middle Fork Hood River
1989	Ad	--	05/09/90	5.4	12.015	East Fork Hood River
1990	Ad-LM	--	04/23/91	5.2	5,356	Middle Fork Hood River
1990	Ad-LM	--	04/23/91	5.2	15,078	East Fork Hood River
Mixed.[c]						
Oak Springs.						
1991	Ad	--	03/31/92	4.6	4,595	East Fork Hood River
Hood River.						
Oak Springs.						
1992	Ad-LP	--	04/06/93	5.8	15.225	Middle Fork Hood River
1992	Ad-LP	--	04/06/93	6.0	15,420	East Fork Hood River
1992	Ad-LP	--	04/06/93	5.6	18.340	East Fork Hood River
1993	Ad-LM	--	04/12-13/94	4.5	7,423	East Fork Hood River
1993	Ad-LV;07-05-36	--	04/12-13/94	4.5	6,863	East Fork Hood River
1993	Ad-LV;07-05-37	--	04/12-13/94	4.5	6.189	East Fork Hood River
1993	Ad-Ltl	--	04/12/94	5.4	2,414	East Fork Hood River
1993	Ad-LV;07-05-38	--	04/12/94	5.4	6,445	East Fork Hood River
1993	Ad-LV;07-05-39	--	04/12/94	5.4	6,531	East Fork Hood River
1993	Ad-LP	--	06/28/94	5.8	2,169	East Fork Hood River
1994	Ad-LV;07-08-63	--	04/19-20/95	5.1	10,534	East Fork Hood River
1994	Ad-LV;07-09-16	--	04/19-20/95	5.1	10.367	East Fork Hood River
1994	Ad-LV;07-09-17..	--	04/19/95	5.4	3,426	East Fork Hood River
1994	Ad-LV;07-09-17	--	04/19/95	5.8	7.707	East Fork Hood River
1994	Ad-LV;07-09-18	--	04/19/95	5.4	3,331	East Fork Hood River
1994	Ad-LV;07-09-18	--	04/19/95	5.8	7,495	East Fork Hood River
1995	Ad-LV-RM:O7-11-31	--	04/02/96	5.5	5.621	Parkdale
1995	Ad-LV-R&07-11-31	--	04/01/96	5.7	11.649	EFk Hood River
1995	Ad-LV-RH:07-11-31	--	04/04/96	5.8	3.508	EFk Hood River
1995	Ad-LV-RM:07-11-32	--	04/22-24/96	5.0	19.913	Parkdale
1995	Ad-RN	--	04/22-24/96	5.0	3.793	Parkdale
1995	Ad-RM	--	04/02/96	5.5	115	Parkdale

Table 65. Continued.

Broodstock. hatchery, brood year	Fin clip[b] or coded wire tag	Survival rate (%)	Date(s) released	Fish/lb	Number released	Release location
Hood River, (cont.)						
Oak Springs.						
1995	Ad-RM	--	04/01/96	5.7	238	EFk Hood River
1995	Ad-RM	--	04/04/96	5.8	72	EFk Hood River
1995	Ad-LV-RM:07-U-31,	--	04/04/96	5.5	749	Hood River (RM 0.5)
1995	Ad-LV-RM:07-11-31	--	04/04/96	5.7	1.553	Hood River (RM 0.5)
1995	Ad-LV-RM:07-11-31	--	04/04/96	5.8	468	Hood River (RM 0.5)
1995	Ad-LV-RM:07-11-32	--	04/22/96	5.0	2,655	Hood River (RM 0.5)
1995	Ad-RM	--	04/04/96	5.0	505	Hood River (RM 0.5)
1995	Ad-RN	--	04/04/96	5.5	15	Hood River (RM 0.5)
1995	Ad-RN	--	04/04/96	5.7	32	Hood River (RM 0.5)
1995	Ad-RM	--	04/04/96	5.8	10	Hood River (RM 0.5)

[a] Production releases prior to the 1987 brood are in Oregon Department of Fish and Wildlife and Confederated Tribes of the Warm Springs Reservation of Oregon (1990).
[b] Ad = Adipose: LV = Left Ventral: LP = Left Pectoral: LM = Left Maxillary: RM = Right Maxillary.
[c] The 1991 brood are progeny of wild x Big Creek stock hatchery crosses.

Table 66. Hatchery juvenile spring chinook salmon releases in the Hood River subbasin by brood year[a].

Life history stage, broodstock, hatchery, brood year	Fin clip[b] or coded, wire tag	Survival rate (%)	Date(s) released	Fish/lb[c]	Number released	Release location
Fingerling,						
Carson,						
Irrigon,						
1985	No mark	--	06/18/86	23.0	92.680	West Fork Hood River
Smolt,						
Carson,						
Bonneville,						
1986	No mark	--	03/14/88	9.4	11.724	West Fork Hood River
1986	No mark	--	03/14/88	9.7	30.895	West Fork Hood River
1986	No mark	--	03/14/88	10.1	11.644	West Fork Hood River
1986	No mark	--	03/14/88	10.2	12.288	West Fork Hood River
1986	No mark	--	03/14/88	10.5	4.988	West Fork Hood River
1986	No mark	--	03/14/88	10.8	9.150	West Fork Hood River
1986	No mark	--	03/14/88	11.1	14.570	West Fork Hood River
1986	Ad;07-42-57	--	03/14/88	11.2	34.548	West Fork Hood River
1986	Ad;07-42-57	--	03/14/88	11.4	14,443	West Fork Hood River
1986	Ad;07-42-57	--	03/14/88	11.6	5.689	West Fork Hood River
1987	No mark	--	03/09/89	10.0	33.013	West Fork Hood River
1987	No mark	--	03/09/89	10.8	31.828	West Fork Hood River
1987	No mark	--	03/09/89	11.0	7.419	West Fork Hood River
1987	Ad;07-42-58	--	03/09/89	11.0	24.698	West Fork Hood River
1987	No mark	--	03/09/89	11.1	8.568	West Fork Hood River
1987	Ad;07-42-58	--	03/09/89	11.1	28.521	West Fork Hood River
1988	Ad;07-52-23	--	03/13/90	9.4	23.970	West Fork Hood River
1988	No mark	--	03/12-13/90	9.9	42,565	West Fork Hood River
1988	No mark	--	03/13/90	10.0	20.799	West Fork Hood River
1988	Ad;07-52-23	--	03/13/90	10.0	10.650	West Fork Hood River
1988	No mark	--	03/12/90	10.1	11.209	West Fork Hood River
1988	No mark	--	03/12/90	10.2	13.973	West Fork Hood River
1988	Ad;07-52-23	--	03/14/90	10.2	10.761	West Fork Hood River
1988	No mark	--	03/12-13/90	10.3	30.483	West Fork Hood River
1988	Ad;07-52-23	--	03/14/90	10.4	14.144	West Fork Hood River
1988	No mark	--	03/12/90	10.5	7,770	West Fork Hood River
1988	No mark	--	03/12/90	10.8	11.664	West Fork Hood River
1989	Ad;07-55-30	--	03/25/91	9.4	53.614	West Fork Hood River
1989	No mark	--	03/25/91	9.8	29.399	West Fork Hood River
1989	No mark	--	03/25/91	11.2	42.419	West Fork Hood River
1990	No mark	--	04/02/92	9.7	41.647	West Fork Wood River
1990	No mark	--	04/02/92	9.9	62.954	West Fork Hood River
1990	Ad;07-56-59	--	04/02/92	10.2	58.694	West Fork Hood River

Table 66. Continued.

Life history stage, broodstock, hatchery, brood year	Fin clip or coded wire tag	Survival rate (%)	Date(s) released	Fish/lb	Number released[c]	Release location
Smolt, (cont.)						
Deschutes,						
Bonneville,						
1991	Ad;07-33-35	--	04/01/93	11.2	11.760	West Fork Hood River
1991	Ad;07-33-35	--	04/01/93	11.3	34.685	West Fork Hood River
1992[d]	--	--	--	--		--
Round Butte,						
1991	Ad;07-50-22 R2	--	04/08-09/93	6.7	28,760	West Fork Hood River
1992[d]				--		
1993	Ad;07-05-49	--	04/04-05/95	13.1	13.111	West Fork Hood River
1993	Ad;07-05-49	--	04/03-04/95	13.2	13.211	West Fork Hood River
1993	Ad;07-05-49	--	04/03/95	13.7	12.865	West Fork Hood River
1993	Ad;07-05-49	--	04/04/95	13.8	13.175	West Fork Hood River
1993	No mark	--	04/04-05/95	13.1	29.455	West Fork Hood River
1993	No mark	--	04/03-04/95	13.2	29.682	West Fork Hood River
1993	No mark	--	04/03/95	13.7	28.905	West Fork Hood River
1993	No mark	--	04/04/95	13.8	29.600	West Fork Hood River
1994	Ad-RV;07-11-30		04/22-23/96	9.5	40.348	West Fork Hood River
1994	Ad-RV;07-11-30		04/10/96	10.0	25.776	West Fork Hood River
1994	Ad-RV;07-11-30		04/08/96	10.1	23,354	West Fork Hood River
1994	Ad-RV;07-11-30		04/09/96	10.3	23,893	West Fork Hood River
1994[e]	Ad;07-09-38		04/22-23/96	9.5	3.509	West Fork Hood River
1994[e]	Ad;07-09-38		04/10/96	10.0	2.241	West Fork Hood River
1994[e]	Ad;07-09-38		04/08/96	10.1	2.031	West Fork Hood River
1994[e]	Ad;07-09-38		04/09/96	10.3	2.078	West Fork Hood River

[a] The 1986 brood release is the first production release of hatchery spring chinook smolts into the Hood River subbasin.
[b] Ad = Adipose: RV = Right Ventral.
[c] Estimates for the i994 brood release were adjusted for mortality at downstream migrant screw traps.
[d] No hatchery spring chinook salmon were released from the 1992 brood.
[e] This coded wire tag group was to have been released in its entirety in the Deschutes River but seals broke around the rotary screens, used to prevent movement among cells in Pelton ladder, allowing a Small percentage of this tag group to mix with fish destined for release in the Hood River.'

Table 67. Estimated numbers of hatchery summer and winter steelhead smolts migrating past a juvenile migrant trap located at RM 4.5 in the mainstem Hood River. (Population estimators and sampling period are in APPENDIX B.)

Race, brood year	Hatchery production release	Estimated number of smolts past mainstem migrant trap			
				% of production release	
		Estimate[a]	95% C.I.	Estimate	Range
Summer.					
1993	90.042	38.234	26.260 - 50.209	42.5	29 - 56
1994	76.330	47.281	3.162 - 91.400	61.9	4 - 100
1995	68.378	28.277	19.782 - 36.772	41.4	29 - 54
Winter.					
1993	38.034	12.201	5.739 - 18.664	32.1	15 - 49
1994	42.860	16,344	1.173 - 31.515	38.1	3 - 74
1995	44.909[b]	32.914	23.011 - 42.817	73.3	51 - 95

[a] Estimate based on the mark:recapture ratio for wild downstream migrant steelhead (see HATCHERY PRODUCTION, Post-Release Survival).

[b] Numbers released above the mainstem migrant trap. An estimated 5.987 hatchery winter steelhead smolts were released below the migrant trap.

Table 68. Estimates of mean fork length (FL: mm), weight (gm), and condition factor (CF) for Hood River stock hatchery winter steelhead smolts sampled at Oak Springs Hatchery prior to release in the Hood River subbasin[a]. Estimates are for small, medium, and large size groups which were ponded separately at the hatchery.

Statistic, size group, brood year	N	Mean	Range	95% C.I.
FL (mm),				
Small,				
1993[b]	130	183.8	115 - 234	± 4.2
Medium,				
1993	192	193.1	82 - 283	± 3.9
1994	207	185.7	116 - 234	± 2.7
1995	c			
Large,				
1993	185	200.2	144 - 246	± 2.9
1994	200	196.9	138 - 247	± 2.5
1995	208	196.1	93 - 236	± 2.6
Weight (gms)				
Small,				
1993	129	69.5	16.0 - 145.5	± 4.8
Medium,				
1993	192	87.2	6.1 - 236.4	± 4.6
1994	207	72.8	16.5 - 154.0	± 3.1
1995	c			
Large,				
1993	185	91.1	33.1 - 168.5	± 3.8
1994	199	86.2	29.6 - 172.1	± 3.2
1995	205	89.6	8.7 - 163.5	± 3.1
CF,[d]				
Small,				
1993	129	1.06	0.88 - 1.22	± 0.006
Medium,				
1993	192	1.15	0.97 - 1.35	± 0.005
1994	207	1.10	0.94 - 1.25	± 0.01
1995	c			
Large,				
1993	185	1.10	0.93 - 1.31	± 0.005
1994	199	1.10	0.97 - 1.24	± 0.01
1995	205	1.16	0.95 - 1.37	± 0.01

[a] Juveniles were sampled approximately one week prior to release in mid-April.
[b] Juveniles were sampled four days prior to release on 28 June 1994.
[c] Juveniles in this size category were not sampled at Oak Springs Hatchery from this brood release group.
[d] Condition factor was estimated as $(100 \cdot weight(gms)/length(cm)^3)$.

Table 69. Estimates of mean fork length (FL: mm), weight (gm), and condition factor (CF) for downstream migrant hatchery summer and winter steelhead released into the Wood River subbasin (see HATCHERY PRODUCTION, Production Releases) and sampled at the mainstem migrant trap.

Race/species, statistic, brood	Sampling period	N	Mean	Range	95% C.I.
Summer steelhead,					
FL (mm),					
1994	04/12-07/06/95	581	208.4	103 - 248	± 1.3
1995	04/06-07/05/96	245	205.0	110 - 258	± 2.3
Weight (gm),					
1994	04/12-07/06/95	574	89.1	25.9 - 154.8	± 1.7
1995	04/06-07/05/96	238	82.3	34.7 - 160.6	± 2.5
CF,[a]					
1994	04/12-07/06/95	574	0.97	0.70 - 1.21	± 0.006
1995	04/06-07/05/96	238	0.92	0.53 - 1.18	± 0.01
Winter steelhead,					
FL (mm),					
1994	04/20-07/04/95	393	208.1	152 - 261	± 1.5
1995	04/15-07/05/96	304	205.7	151 - 247	± 1.8
Weight (gm),					
1994	04/20-07/04/95	384	89.4	29.8 - 198.6	± 2.2
1995	04/15-07/05/96	274	84.7	34.7 - 135.7	± 2.3
CF,[a]					
1994	04/20-07/04/95	384	0.98	0.77 - 1.31	± 0.007
1995	04/15-07/05/96	274	0.96	0.80 - 1.28	± 0.008

[a] Condition factor was estimated as $(100 * weight(gms)/length(cm)^3)$.

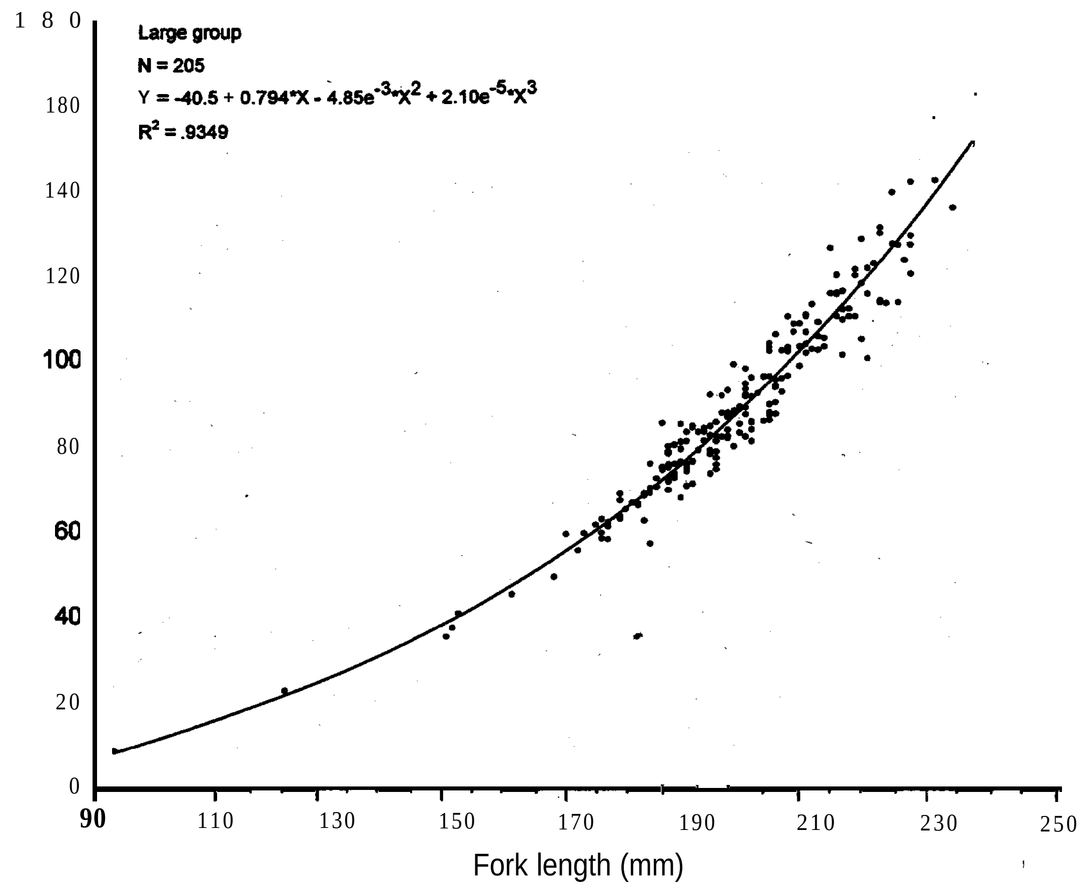

Figure 27. Length x weight regression of the large-sized group of Hood River stock hatchery winter steelhead released into the Hood River subbasin from Oak Springs Hatchery, 1996.

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APPENDIX A

Summary Counts and Statistics for Two and Three Pass Removal Estimates on Rainbow-Steelhead and Cutthroat Trout

Appendix Table A-1. **Removal** estimates of population **numbers** for two size categories of **rainbow-steelhead sampled** in selected reaches of stream located in the Hood River subbasin. 1996. Included are **numbers** of fish sampled in each pass.

Location, sampling area	Sampling date	River mile	Reach length (m)	Rainbow-steelhead less than 85 mm fork length					Rainbow-steelhead greater than or equal to 85 mm fork length					Total	
				Pass 1	Pass 2	Pass 3	N	90% C.I.[a]	Pass 1	Pass 2	Pass 3	N	90% C.I.[a]	N[b]	90% C.I.[a]
Mainstem.															
Neal Creek	08/29/96	0.0	55.0	31	15	4	53.4	± 5.9	14	0	2	16.2	c	69.1	± 5.2
Lenz Creek	09/03/96	0.5	60.0	0	0	--	0	--	1	0	--	1.0	c	1.0	c
West Fork.															
Greenpoint Cr	09/05/96	1.0	64.0	40	17	7	69.1	± 7.7	81	20	9	122.7	± 6.2	191.4	± 9.2
Lake Branch	09/19/96	0.2	60.0	57	13	7	79.2	± 4.0	19	6	2	27.9	± 9.8	107.2	± 4.8
Red Hill Cr	09/12/96	0.1	60.0	45	12	3	61.1	± 2.6	a	2	0	10.1	c	71.1	± 2.6
Elk Creek	08/28/96	0.5	65.0	60	17	2	80.0	± 2.4	31	4	3	38.5	c	118.5	± 2.9
Middle Fork.															
Rogers Creek	09/25/96	0.2	60.0	1	0	0	1.0	c	9	5	2	18.2	c	18.8	c
East Fork.															
Evans Creek	09/24/96	0.1	58.0	46	8	3	57.6	± 1.8	17	2	1	20.6	c	77.7	± 1.9
Bog River	09/04/96	0.7	60.0	14	12	7	53.1	±44.0	3	4	0	5.4[d]	--	58.5	±34.1

[a] The standard error formula in Zippin (1958) was used to estimate confidence intervals. This formula Is satisfactory for estimating the 95% confidence interval for populations greater than 200 fish. For populations ranging from 50-200 fish, "in which the assunption'are assumed to hold reasonably well. the above method provides approximately 90 percent confidence limits rather than 95 percent limits" (Zippin 1958).

[b] Total population size was estimated based on the total catch for each pass. As a result, the estimate of total population size may not equal the sun of the estimated population sizes in each size category.

[c] Estimated population size too small to accurately estimate confidence limits (*see* Zippin 1958).

[d] Population estimates for the upper size category were determined by subtracting the estimate for the lower size category from the total estimate.

Appendix Table A-2. Removal estimates of population numbers for two size categories of cutthroat trout sampled in selected reaches of stream located in the Hood River subbasin. 1996. Included are numbers of fish sampled in each pass.

Location, sampling area	Sampling date	River mile	Reach length (m)	Cutthroat trout less than 85 mm fork lenath					Cutthroat trout greater than or equal to 85 mm fork length					Total	
				Pass 1	Pass 2	Pass 3	N	90% C.I.[a]	Pass 1	Pass 2	Pass 3	N	90% C.I.[a]	N[b]	90% C.I.[a]
Middle Fork.															
Rogers Creek	09/25/96	0.2	60.0	0	0	0	0	--	0	1	0	1.0[c]	--	1.0[c]	--
East Fork.															
Evans Creek	09/24/96	0.1	58.0	1	0	0	1.0	d	3	1	0	4.0	d	5.0	d
Dog River	09/04/96	0.7	60.0	2	0	0	2.0	d	18	2	1	21.1	d	23.1	d
Robinhood Cr	09/17/96	1.0	60.0	39	18	8	71.8	± 9.6	31	7	3	41.9	d	112.4	± 7.9

[a] The standard error formula in Zippin (1958) was used to estimate confidence intervals. This formula is satisfactory for estimating the 95% confidence interval for populations greater than 200 fish. For populations ranging from 50-200 fish. "in which the assunptions are assumed to hold reasonably well. the above method provides approximately 90 per cent confidence limits rather than 95 percent limits" (Zippin 1958).

[b] Total population size was estimated based on the total catch for each pass. As a result. the estimate of total population size may not equal the sun of the estimated population sizes in each size category.

[c] Estimate assuned to be one.

[d] Estimated population size too small to accurately estimate confidence limits (see Zippin 1958).

APPENDIX B

Parameters Used to Estimate Rainbow-Steelhead Migrants to the Mainstem Migrant Trap

Appendix Table B-l. Number of migrant wild rb-st and hatchery summer and winter steelhead marked (M), caught (C), and recaptured (R) at the mainstem migrant. Numbers marked at migrant traps located in the West, Middle, and East forks of the Hood River and recaptured at the mainstem migrant trap are in parenthesis.

Origin, race, year	Sampling period	M	C	R	Percent recapture
Wild,					
Unknown,[a]					
1994	03/23-07/31/94	354	418	14	3.9
1995	03/30-07/31/95	226 (337)	248	6 (5)	2.7 (1.5)
1996	04/03-07/31/96	572 (200)	655	42 (10)	7.3 (5.0)
Hatchery,					
Summer,					
1994	03/23-07/31/94	1.110	1.410	40	3.6
1995	03/30-07/31/95	1.100 (1.296)	1.470	19 (9)	1.7 (0.7)
1996	04/03-07/31/96	1.083 (1.019)	2,121	42 (27)	3.9 (2.6)
Winter,					
1994	03/23-07/31/94	429	453	15	3.5
1995	03/30-07/31/95	460 (1.256)	500	3 (23)	0.7 (1.8)
1996	04/03-07/31/96	1.155 (695)	2,479	52 (37)	4.5 (5.3)

[a] Race unknown. May include wild summer and winter steelhead and wild rainbow trout.

APPENDIX C

Summary of Fish Biomass per m^2 and m^3 at Selected Sampling Sites in the Hood River Subbasin

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Appendix Table C-l. Estimates of surface area (m^2/100 m), density (fish/1000 m^2), and biomass (grams/100 m^2) for resident salmonids[a] and non-salmonids[a] sampled at selected sites in the Hood River subbasin. 1996. (Estimates for hatchery produced steelhead are in parentheses. Sampling dates, reach lengths, and removal numbers for each pass (i.e.. rb-st and cutthroat trout) are presented in APPENDIX A.)

Location. sampling area	River mile	m^2/100 m	Fish/1000 m^2 ChSp	Rb-St <85mm	Rb-St ≥85mm	Cutthroat <85mm	Cutthroat ≥85mm	Dace	BrBhd	cot	Total	Grams/100 m^2 ChSp	Rb-St	Ct	Dace	BrBhd	Cot	Total
Mainstem.																		
Neal Cr	0.0	808.6	0	120	36	0	0	1,422	7[b]	212	1.797	0	141	0	95	11	101	348
Lenz Cr	0.5	293.2	0	0	6	0	0	0	0	30	36	0	44	0	0	0	24	68
West Fork,																		
Greenpoint Cr	1.0	980.2	0	110	196	0	0	0	0	91	397	0	598	0	0	0	72	670
Lake Branch	0.2	1.285.9	0	103	36	0	0	0	0	332	471	0	164	0	0	0	186	350
Red Hill Cr	0.1	439.2	0	232	38	0	0	0	0	117	387	0	171	0	0	0	47	218
Elk Cr	0.5	496.6	0	248	119	0	0	0	0	49	416	0	320	0	0	0	35	355
Middle Fork.																		
Rogers Cr	0.2	483.9	0	3	63	0	3[b]	0	0	403	472	0	329	29	0	0	153	511
East Fork,																		
Evans Cr	0.1	482.4	0	206	72	4	14	0	0	67	363	0	231	60	0	0	64	355
Dog River	0.7	531.4	0	167	16[c]	6	66	0	0	322	577	0	82	133	0	0	183	398
Robinhood Cr	1.0	310.9	0	0	0	385	225	0	0	1.647	2,267	0	0	604	0	0	680	1.284

[a] ChSp = spring chinook, Rb-St = rainbow-steelhead. Cot = Cottid. Ct = cutthroat trout, BrBhd = Brown Bullhead.

[b] Estimate derived based on total catch.

[c] Population estimate for wild rb-st greater than or equal to 85mm was determined by subtracting the estimate for the smaller size category fran the estimated total.

Appendix Table C-2. Estimates of volw (m³/100 m), density (fish71000 m³). and biomass (grams1100 m³) for resident salmonids[a] and non-salmonids[a] sampled at selected sites in the Hood River subbasin. 1996. (Estimates for hatchery produced steelhead are in parentheses. Sampling dates, reach lengths, and removal numbers for each pass (i.e.. rb-st and cutthroat trout) are presented In APPENDIX A.)

Location, sampling area	River mile	$m^3/100$ m	Fish/1000 m^3 ChSp	Rb-St <85mm	Rb-St ≥85mm	Cutthroat <85mm	Cutthroat ≥85mm	Dace	BrBhd	cot	Total	Grams/100 m^3 ChSp	Rb-St	Ct	Dace	BrBhd	Cot	Total
Mainstem.																		
Neal Cr	0.0	135.9	0	714	217	0	0	8,461	40[b]	1.260	10.692	0	846	0	568	61	598	2.073
Lenz Cr	0.5	42.3	0	0	39	0	0	0	0	205	244	0	287	0	0	0	162	449
West Fork.																		
Greenpoint Cr	1.0	162.2,	0	665	1.182	0	0	0	0	551	2.398	0	3.608	0	0	0	435	4.043
Lake Branch	0.2	351.7	0	375	132	0	0	0	0	1.214	1.721	0	599	0	0	0	679	1.278
Red Hill Cr	0.1	48.6	0	2,095	346	0	0	0	0	1.052	3,493	0	1.552	0	0	0	424	1.976
Elk Cr	0.5	46.5	0	2,649	1.275	0	0	0	0	520	4.444	0	3,425	0	0	0	374	3.799
Middle Fork.																		
Rogers Cr	0.2	125.9	0	13	241	0	13b	0	0	1.547	1,814	0	1.261	126	0	0	586	1,973
East Fork.																		
Evans Cr	0.1	62.0	0	1.601	559	28	111	0	0	523	2.822	0	1.791	479	0	0	501	2.771
Bog River	0.7	64.5	0	1,373	139[c]	52	545	0	0	2,655	4,764	0	708	1,096,	0	0	1.506	3,310
Robinhood Cr	1.0	43.2	0	0	0	2,769	1.616	0	0	11,847	16.232	0	0	4.340	0	0	4.894	9.234

[a] ChSp = spring chinook, Rb-St = rainbow-steelhead. Cot = Cottld. Ct = cutthroat trout. BrBhd = Brown Bullhead.
[b] Estimate derived based on total catch.
[c] Population estimate for wild rb-st greater than or equal to 85mm was determined by subtracting the estimate for the smaller size category fran the estimated total.

APPENDIX D

Length x Weight Regression Coefficients for
Fish Sampled in the Hood River Subbasin

Appendix Table D-l. Regression coefficients and coefficient of multiple determination for second and third order polynomial **functions**[a] defined by the regression of weight on length for ralnbow-steelhead sampled at selected locations in the Hood River subbasin. by area and river mile.

Location. area. year	RM	Sample Size	Regression coefficients b_0	b_1	b_2	b_3	Range of independent variable X	R^2
Mainstem.								
Neal Cr.								
1995	0	21	-5.6414	$2.2860*10^{-1}$	$-2.9205*10^{-3}$	$2.3571*10^{-5}$	46-148	.9972
19%	0	66	3.5028	$-1.1749*10^{-1}$	$1.2088*10^{-3}$	$8.6215*10^{-6}$	54-169	.9872
1994	1.5	27	'20.1214	$-5.0545*10^{-1}$	$3.9989*10^{-3}$	$6.3696*10^{-7}$	67-203	.9958
1995	1.5	23	-18.1375	$6.6836*10^{-1}$	$-7.3978*10^{-3}$	$3.7550*10^{-5}$	54-182	.9952
1994	5.0	104	$-3.2042*10^{-1}$	$1.9167*10^{-2}$	$-2.3061*10^{-4}$	$1.1458*10^{-5}$	42-165	.9863
1995	5.0	121	7.2869	$-3.0748*10^{-1}$	$3.8412*10^{-3}$	$-2.0223*10^{-6}$	38-160	.9924
West Fork.								
Greenpoint Cr.								
1994	1.0	212	1.4530	$-3.6656*10^{-2}$	$3.1484*10^{-4}$	$9.7839*10^{-6}$	44-215	.9957
1995	1.0	203	-1.4418	$6.1076*10^{-2}$	$-7.5679*10^{-4}$	$1.3950*10^{-5}$	40-192	.9903
19%	1.0	170	-5.9046	$1.8605*10^{-1}$	$-1.7370*10^{-3}$	$1.6577*10^{-5}$	62-206	.9878
Lake Branch.								
1994	0.2	253	-10.6760	$3.5100*10^{-1}$	$-3.5245*10^{-3}$	$2.0989*10^{-5}$	46-242	.9964
1995	0.2	220	-5.6578	$2.2177*10^{-1}$	$-2.5029*10^{-3}$	$1.9063*10^{-5}$	39-172	.9864
19%	0.2	103	$-5.9184*10^{-2}$	$1.1984*10^{-2}$	$-2.0315*10^{-4}$	$1.1726*10^{-5}$	36-201	.9828
1994	4.0	56	-79.4645 .	2.0606 .	$-1.6907*10^{-2}$	$5.3721*10^{-5}$	70-210	.9776
1995	4.0	81	3.0583	$-1.0288*10^{-1}$	$1.2600*10^{-3}$	$6.2476*10^{-6}$	59-192	.9950
1994	7.0	18	3.9968	$-1.5682*10^{-1}$	$1.6401*10^{-3}$	$5.8559*10^{-6}$	38-209	.9977
1995	7.0	69	2.2413	$-9.5845*10^{-2}$	$1.0990*10^{-3}$	$7.2198*10^{-6}$	30-236	.9925
Red Hill Cr.								
1996	0.1	70	-5.1400	$2.3066*10^{-1}$	$-3.1502*10^{-3}$	$2.4418*10^{-5}$	40-153	.9974
1994	1.0	15	47.4733	-1.0203	$6.4493*10^{-3}$	--	81-205	.9993
1995	1.0	20	7.4697	$-3.1043*10^{-1}$	$3.4673*10^{-3}$	$-1.5597*10^{-7}$	35-188	.9936
McGee Cr.								
1994	0.5	48	-8.0983	$2.8437*10^{-1}$	$-3.0610*10^{-3}$	$2.1462*10^{-5}$	51-197	.9979
1996	0.5	31	$9.8845*10^{-1}$	$-2.8407*10^{-2}$	$1.8927*10^{-4}$	$1.1251*10^{-5}$	31-206	.9841
Elk Cr.								
1994	0.5	27	-1.6782	$5.8475*10^{-2}$	$-5.8395*10^{-4}$	$1.2722*10^{-5}$	35-228	.9978
1995	0.5	62	$8.3891*10^{-3}$	$-1.9877*10^{-3}$	$-2.9564*10^{-5}$	$1.1507*10^{-5}$	30-174	.9919
1996	0.5	109	$-5.5197*10^{-2}$	$-1.5871*10^{-2}$	$4.9728*10^{-4}$	$8.6366*10^{-6}$	41-203	.9950
Middle Fork.								
MFk Hood R..								
1994	4.5	25	-5.0846	$1.3928*10^{-1}$	$-9.8032*10^{-4}$	$1.2978*10^{-5}$	58-176	.9983
Tony Cr.								
1994	1.0	19	-3.5411	$1.5036*10^{-1}$	$-1.9446*10^{-3}$	$1.8155*10^{-5}$	41-148	.9884
1995	1.0	33	$4.9313*10^{-1}$	$4.6901*10^{-3}$	$-4.1367*10^{-4}$	1.4445*10-5	36-182	.9987
Rogers Cr.								
1996	0.2	17	12.3195	$-3.5635*10^{-1}$	$2.9185*10^{-3}$	$5.3452*10^{-6}$	52-225	.9911
East Fork.								
EFk Hood R..								
1994	0.5	97	$1.8433*10^{-1}$	$-1.4608*10^{-2}$	$2.8844*10^{-4}$	$1.0046*10^{-5}$	45-200	.9914
1995	0.5	66	-5.0097	$2.1240*10^{-1}$	$-2.6466*10^{-3}$	$2.1621*10^{-5}$	54-186	.9975
1994	5.5	68	-11.3845	$4.0749*10^{-1}$	$-4.4589*10^{-3}$	$2.4655*10^{-5}$	52-157	.9767
1995	5.5	79	5.9150	$-2.6242*10^{-1}$	$3.4551*10^{-3}$	$-8.6360*10^{-7}$	30-161	.9860

Appendix Table D-1. Continued.

Location, area, year	RM	Sample Size	Regression coefficients b_0	b_1	b_2	b_3	Range of independent variable X	R^2
East Fork. (cont.)								
Evans Cr.								
1996	0.1	77	5.8882	$-2.2375*10^{-1}$	$2.5397*10^{-3}$	$2.9537*10^{-6}$	40-186	.9934
Dog River.								
1995	0.3	11	3.7310	$-1.9136*10^{-1}$	$2.8451*10^{-3}$	--	35-143	.9923
1996	0.7	40	$-2.7457*10^{-1}$	$4.0258*10^{-2}$	$-1.0893*10^{-3}$	$1.6886*10^{-5}$	26-196	.9990

[a] Polynomial functions are $\hat{Y} = b_0 + b_1X + b_2X^2$ (i.e.. 2°) and $\hat{Y} = b_0 + b_1X + b_2X^2 + b_3X^3$ (i.e.. 3°) where $\hat{Y}$ is the estimated weight at length (X).

Appendix Table D-2. Regression coefficients and coefficient of multiple determination for second and third order polynomial functions[a] defined by the regression of weight on length for cutthroat trout sampled at selected locations in the Hood River subbasin. by area and river mile.

Location. area. year	RM	Sample Size	Regression coefficients b_0	b_1	b2	b_3	Range of independent variable X	R2
mainstem,								
Neal Creek,								
1995	5.0	13	3.0582	$-1.8630*10^{-1}$	$2.8475*10^{-3}$	--	53-159	.9864
Riddle Fork.								
Tony Cr.								
1994	1.0	24	11.5193	$-3.9035*10^{-1}$	$4.0910*10^{-3}$	$-3.0804*10^{-6}$	48-178	.9961
1995	1.0	56	-5.9636	$2.0300*10^{-1}$	$-2.1947*10^{-3}$	$1.8827*10^{-5}$	51-205	.9828
Dear Cr.								
1994	0.6	74	-10.0744	$3.4036*10^{-1}$	$-3.5601*10^{-3}$	$2.1449*10^{-5}$	58-190	.9812
1995	0.6	112	-3.4768	$1.5935*10^{-1}$	$-1.9673*10^{-3}$	$1.7454*10^{-5}$	34-170	.9799
East Fork.								
EFk Hood R..								
1994	0.5	4	10.7781	$-3.1904*10^{-1}$	$3.1468*10^{-3}$	--	68-114	.9999
1995	0.5	9	9.3531	$-3.0119*10^{-1}$	$3.1567*10^{-3}$	--	62-191	.9999
Evans Cr.								
19%	0.1	4	195.3533	-2.7603	$1.1055*10^{-2}$	--	131-200	.9981
Dog River.								
1994	0.3	30	$-6.4065*10^{-1}$	$5.0255*10^{-2}$	$-6.0473*10^{-4}$	$1.2742*10^{-5}$	42-203	.9935
1995	0.3	21	-19.7984	$4.6293*10^{-1}$	$-2.9956*10^{-3}$	$1.5783*10^{-5}$	69-238	.9966
19%	0.7	23	13.6456	-2.1029*10-l	$4.6285*10^{-4}$	$1.3285*10^{-5}$	79-185	.9968
Tilly Jane Cr.								
1994	0.1	25	6.3276	$-2.3135*10^{-1}$	$2.5873*10^{-3}$	$1.0387*10^{-6}$	44-165	.9874
1995	0.1	114	1.2119	$-6.0256*10^{-2}$	$1.0264*10^{-3}$	$5.6638*10^{-6}$	30-183	.9848
Robinhood Cr.								
1994	1.0	54	1.11%	$-4.0764*10^{-2}$	$3.6773*10^{-4}$	$9.5484*10^{-6}$	39-200	.9957
1995	1.0	90	1.0441	$-5.0096*10^{-2}$	$6.7671*10^{-4}$	$7.6914*10^{-6}$	22-210	.9952
19%	1.0	06	3.4674	$-1.3442*10^{-1}$	$1.4112*10^{-3}$	$6.2403*10^{-6}$	32-221	.9946

[a] Polynanial functions are $\hat{Y} = b_0 + b_1X + b_2X^2$ (i.e.. 2°) and $\hat{Y} = b_0 + b_1X + b_2X^2 + b_3X^3$ (i.e.. 3°) where Y is the estimated weight at length (X).

Appendix Table O-3. Regression coefficients and coefficient of multiple determination for second and third order polynomial functions[a] defined by the regression of weight on length for sculpins sampled at selected locations in the Hood River subbasin. by area and river mile.

Location. area. year	RM	Sample Size	Regression coefficients b_0	b_1	b_2	b_3	Range of independent variable X	R2
mainstein.								
Neal Creek.								
1995	0	a6	$4.4969*10^{-1}$	$-3.0165*10^{-2}$	$6.5185*10^{-4}$	$8.1635*10^{-6}$	26- 82	.9615
1996	0	66	-1.6583	$5.5024*10^{-2}$	$-2.1158*10^{-4}$	$1.2080*10^{-5}$	34-120	.9857
1994	1.5	52	$-9.6086*10^{-1}$	$6.3794*10^{-2}$	$-1.0500*10^{-3}$	$2.6336*10^{-5}$	27- 66	.9291
1995	1.5	106	-3.4454	$2.2453*10^{-1}$	$-4.4678*10^{-3}$	$4.1374*10^{-5}$	25- 80	.9305
1994	5.0	25	24.0020	-1.1227	$1.6890*10^{-2}$	$-6.8977*10^{-5}$	45- 99	.9756
1995	5.0	43	$5.1580*10^{-1}$	$-1.7534*10^{-2}$	$-9.1492*10^{-5}$	$1.4939*10^{-5}$	24-110	.9761
Lenz Cr.								
1996	0.5	5	85.6840	-2.2049	$1.5231*10^{-2}$	--	75- 92	.9931
West Fork.								
Greenpoint Cr.								
1994	1.0	60	6.6279	$-1.7236*10^{-1}$	$1.0858*10^{-3}$	$1.2189*10^{-5}$	52-115	.9721
1995	1.0	56	$7.1442*10^{-1}$	$-2.9596*10^{-2}$	$1.5146*10^{-4}$	$1.3133*10^{-5}$	28-116	.9837
1996	1.0	39	3.8178	-2.0231*10-l	$2.9228*10^{-3}$	$1.1604*10^{-7}$	28-114	.9797
Lake Branch.								
1994	0.2	51	6.4784	-2.1843*10-l	$2.2817*10^{-3}$	$3.5145*10^{-6}$	52-111	.9686
1995	0.2	54	2.5814	$-1.5088*10^{-1}$	$2.5187*10^{-3}$	$-1.7321*10^{-6}$	27-103	.9739
19%	0.2	121	$5.4285*10^{-1}$	$-6.0350*10^{-2}$	$1.5703*10^{-3}$	--	22-106	.8191
1994	4.0	81	22.3301	$-8.6500*10^{-1}$	$1.0504*10^{-2}$	$-2.8931*10^{-5}$	52-126	.9734
1995	4.0	131	2.0402	$-1.2376*10^{-1}$	$2.1163*10^{-3}$	$3.4385*10^{-7}$	25-117	.9837
1994	7.0	51	$2.5193*10^{-1}$	$-1.8662*10^{-2}$	$3.0346*10^{-4}$	$1.0015*10^{-5}$	40-101	.9632
1995	7.0	210	1.1997	$-4.8185*10^{-2}$	$5.3011*10^{-4}$	$9.0533*10^{-6}$	36- 96	.9716
Red Hill Cr.								
19%	0.1	19	8.0729	$-3.4635*10^{-1}$	$4.6186*10^{-3}$	$-7.8607*10^{-6}$	43-111	.9915
McGee Cr.								
1994	0.5	16	-2.3792	1.4777*10-l	$-2.8586*10^{-3}$	$2.7691*10^{-5}$	48-123	.9950
1995	0.5	42	13.7591	$-5.3561*10^{-1}$	$6.3980*10^{-3}$	$-1.2698*10^{-5}$	47 -129	.9772
Elk Cr.								
1994	0.5	25	$3.8641*10^{-1}$	$-1.8013*10^{-2}$	$7.8375*10^{-5}$	$1.3100*10^{-5}$	43-115	.9905
1995	0.5	22	7.1630	$-3.2714*10^{-1}$	$4.4679*10^{-3}$	$-6.3181*10^{-6}$	53-132	.9945
1996	0.5	15	-10.3391	$4.7759*10^{-1}$	$-7.0769*10^{-3}$	$4.4734*10^{-5}$	55-122	.9971
Middle Fork,								
MFk Hood R..								
1994	4.5	21	-8.1680	$3.3002*10^{-1}$	$-4.5270*10^{-3}$	$3.2058*10^{-5}$	56-112	.9826
Tony Cr.								
1994	1.0	51	5.0309	$-2.4207*10^{-1}$	$3.7096*10^{-3}$	$-5.3533*10^{-6}$	40-112	.9741
1995	1.0	41	2.0800	$-1.1913*10^{-1}$	$1.8958*10^{-3}$	$3.6624*10^{-6}$	26-121	.9545
Rogers Cr.								
19%	0.2	69	1.4249	$-8.0202*10^{-2}$	$1.3801*10^{-3}$	$4.1538*10^{-6}$	23-111	.9822
East Fork.								
EFk Hood R..								
1994	0.5	95	4.0734	$-2.1133*10^{-1}$	$3.4266*10^{-3}$	$-4.1743*10^{-6}$	35-120	.9853
1995	0.5	51	$1.8122*10^{-1}$	$2.4497*10^{-2}$	$-1.2505*10^{-3}$	$2.4976*10^{-5}$	26-114	.9788
1994	5.5	25	12.5503	$-4.3553*10^{-1}$	$4.7560*10^{-3}$	$-3.1815*10^{-6}$	58-110	.9838
1995	5.5	62	1.5697	$-7.5078*10^{-2}$	$7.6186*10^{-4}$	$1.2320*10^{-5}$	23-112	.9873
Evans Cr.								
1996	0.1	17	$7.9680*10^{-1}$	$-8.5043*10^{-2}$	$1.9858*10^{-3}$	—	33-116	.9306

Appendix Table D-3. Continued.

Location. area. year	RM	Sample Size	Regression coefficients b_0	b_1	b_2	b_3	Range of independent variable X	R^2
East [illegible]Riv. (cont.)								
Do[illegible] 'ver.								
	0.3	33	-5.4740	$8.9894*10^{-2}$	$1.0557*10^{-3}$	--	52-93	.7406
1995	0.3	31	4.7388	$-2.1919*10^{-1}$	$3.1062*10^{-3}$	$-1.1593*10^{-6}$	45-105	.9804
1996	0.7	75	3.6741	$-1.8435*10^{-1}$	$2.7136*10^{-3}$	--	38-102	.9651
Tilly Jane Cr.								
1994	0.1	32	-2.1577	$9.6831*10^{-2}$	$-1.6383*10^{-3}$	$2.0830*10^{-5}$	55-110	.9745
1995	0.1	127	-1.7603	$1.0062*10^{-1}$	$-1.8651*10^{-3}$	$2.2811*10^{-5}$	24-118	.9708
Robinhood Cr.								
1994	1.0	30	-1.8066	$1.1157*10^{-1}$	$-2.1928*10^{-3}$	$2.5510*10^{-5}$	45-96	.9770
1995	1.0	94	-2.4425	$1.3094*10^{-1}$	$-2.4534*10^{-3}$	$2.6478*10^{-5}$	37-104	.9865
1996	1.0	39	-1.2866	$9.2352*10^{-2}$	$-1.9560*10^{-3}$	$2.3697*10^{-5}$	23-96	.9893

[a] Polynomial functions are $\hat{Y} = b_0 + b_1X + b_2X^2$ (i.e.. 2°) and $\hat{Y} = b_0 + b_1X + b_2X^2 + b_3X^3$ (i.e.. 3°) where Y is the estimated weight at length (X).

APPENDIX E

Estimates of Anglers and Effort (Hours Fished) in the Hood River Sport Fishery

Appendix Table E-l. Estimated nunbers of anglers, hours fished, and mean hours fished in the Hood River sport fishery located from the mouth of the -Hood River to 0.3 miles above Powerdale Dam (RM 4.8). 1996.

Period	Anglers	Hours fished	Mean hours fished
Jan 1-15	373	798	2.1
Jan 16-31	279	579	2.1
Feb 1-15	--	97	--
Feb 16-29	293	576	2.0
Mar 1-15	459	1.190	2.6
Mar 16-31	728	2.036	2.0
Apr 1-15	742	2.642	3.6
Apr 16-30	730	1.871	2.6
May 1-15	713	2.009	2.8
May 16-31	1.020	3.160	3.1
Jun l-15	578	1.851	3.2
Jun 16-30	753	2.015	2.7
Jul 1-15	387	1,011	2.6
Jul 16-31	279	590	2.1
Aug 1-15	184	344	1.9
Aug 16-31	201	531	2.6
sep 1-15	125	249	2.0
Sep 16-30	104	154	1.5
Oct 1-15	142	97	0.7
Oct 16-31	106	186	1.7
Nov 1-15	136	347	2.5
Nov 16-30	109	230	2.1
Dec 1-15	81	162	2.0
Dec 16-31	230	548	2.4

APPENDIX F

Harvest of Stray Hatchery Summer and Winter Steelhead in the Hood River Subbasin

Appendix Table F-1. Estimated sport harvest of stray hatchery adult summer and winter steelhead in the Hood River sport fishery located from the mouth of the Hood River to 0.3 miles above Powerdale Dam (RM 4.8). 19%. Confidence limits (95%) are in parenthesis.

Period'	Strav hatchery summer steelhead		Stray hatchery winter steelhead		Catch Rate
	Kept	Released	Kept	Released	(hrs/fish)
Jan 1-15	--		4 (4.9)	--	200
Jan 16-31			--	--	--
Feb 1-15			--	--	--
Feb 16-29	--			--	--
Mar 1-15	--	--	3 (4.1)	--	397
Mar 16-31	6 (10.0)	3 (4.9)	4 (6.8)	--	157
Apr 1-15	4 (7.7)		4 (7.7)	--	294
Apr 16-30	--	--	--	--	--
May 1-15	--		--	--	
May 16-31	--	--	--	--	--
Jun 1-15	--		--	--	
Jun 16-30		--	--	--	--
Jul 1-15	3 (5.7)		--	--	337
Jul 16-31	--	--	--	--	--
Aug 1-15	--	--	--	--	
Aug 16-31	--	--	--	--	--
Sep 1-15	--	--	--	--	--
Sep 16-30	--	--	--	--	
Oct 1-15		--		--	--
Oct 16-31	6 (10.2)			--	31
Nov 1-15	1 (2.3)				347
Nov 16-30	--		--	--	--
Dec 1-15	8 (12.7)				20
Dec 16-31		--	--		--
Total	28 (22)	3 (5)	15 (12)		506

REPORT B

HOOD RIVER AND PELTON LADDER

ANNUAL PROGRESS REPORT
1996

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IRTRODUCTIOR

The Hood River Production Program (HRPP) was discussed in Report A, page 5. The HRPP is jointly implemented by the Confederated Tribes of the Warm Springs Reservation of Oregon (CTWS) and the Oregon Department of Fish and Wildlife (ODFW). The primary goals of the HRPP are (1) to re-establish naturally sustaining spring chinook salmon using Deschutes River stock in the Hood River subbasin, (2) rebuild naturally sustaining runs of summer and winter steelhead in the Hood River subbasin, (3) maintain the genetic characteristics of the populations, and (4) contribute to tribal and non-tribal fisheries, ocean fisheries, and the Northwest Power Planning Council's (NPPC) interim goal of doubling salmon runs.

The contract period for FY 96 was 1 October, 1995 through 30 September, 1996. Work implemented by Warm Springs staff during FY 96 included (1) acclimation of hatchery spring chinook salmon and winter steelhead smolts, (2) genetic analysis of steelhead [contractual services], (3) radio telemetry study to evaluate upstream migration of adult spring chinook salmon, fall chinook salmon, and summer steelhead in the lower Hood River, (4) Hood River water'temperature studies, (5) Oak Springs Hatchery (OSH) coded-wire tagging and clipping evaluation, (6) habitat restoration and monitoring, (7) Pelton Ladder evaluation and coordination of ladder modifications, (8) management advice and guidance to Bonneville Power Administration (BPA) and ODFW engineering on HRPP facilities, (9) assistance to BPA in preparation of the Hood River Environmental Impact Statement, and (10) preparation of an annual report sumnariting project objectives for FY 96.

HOOD RIVER

ACCLIMATION

Introduction

The Hood River Production Master Plan (1991) originally called for acclimating half of the hatchery spring chinook salmon (*Oncorhynchus tshawytscha*) and summer steelhead (*Oncorhynchus mykiss*) smolts and none of the winter steelhead smolts prior to release into the Hood River subbasin. The remaining smolts were to be directly released into the subbasin. This approach was designed to evaluate the benefits associated with acclimation prior to implementing full acclimation for all species (Department of Natural Resources (CTWS) 1993). When the NPPC accepted the Hood River Production Master Plan in 1992, they strongly encouraged development of "facilities to acclimate all smolts to be released into the Hood River subbasin where it is feasible to provide such facilities" (NPPC 1992). Furthermore, the NPPC encouraged fishery managers to "use temporary and/or portable facilities wherever possible to reduce costs and facilitate their removal if monitoring and evaluation show them not to be needed". Therefore, all hatchery produced spring chinook salmon and winter steelhead smolts were acclimated inportable raceways prior to a volitional release in 1996. One acclimation pond for winter steelhead on the East Fork Hood River (20.5 river-miles [Rm] from the Columbia River) and two acclimation ponds for spring chinook salmon on the West Fork Hood River (21 Rm from the Columbia River) were utilized for acclimation.

Prior to spring chinook salmon juveniles being transported to the Wood River for acclimation, they were reared for approximately six months at Pelton Ladder. Pelton Ladder is located in the Deschutes River subbasin, at Rm 100 (See Pelton Ladder Section, Figures 15 & 16). This was the first year spring chinook juveniles, for release into the Hood River, had been reared at Pelton Ladder.

HRPP tribal staff had three key objectives for the acclimation project on the Hood River (Department of Natural Resources (CTWS) 1993):

1. Determine if acclimation significantly influences homing of spring chinook salmon and winter steelhead.
2. Determine if acclimated smolts result in a higher smolt to adult survival rate than directly released smolts.
3. Determine if outmigration is similar between hatchery acclimated smolts and naturally -produced smolts.

Therefore, winter steelhead and spring chinook salmon were acclimated near primary spawning habitat with the intent that they would imprint and home back to their primary spawning areas. In addition, smolts were acclimated a minimum of four days prior to release from the acclimation ponds to reduce stress and improve survival (Schreck et al. 1989; Whitesel et al. 1994). Finally, hatchery winter steelhead and spring chinook salmon smolts were allowed to emigrate volitionally when physiologically and morphologically ready.

History Of Hatchery Releases For The HRPP

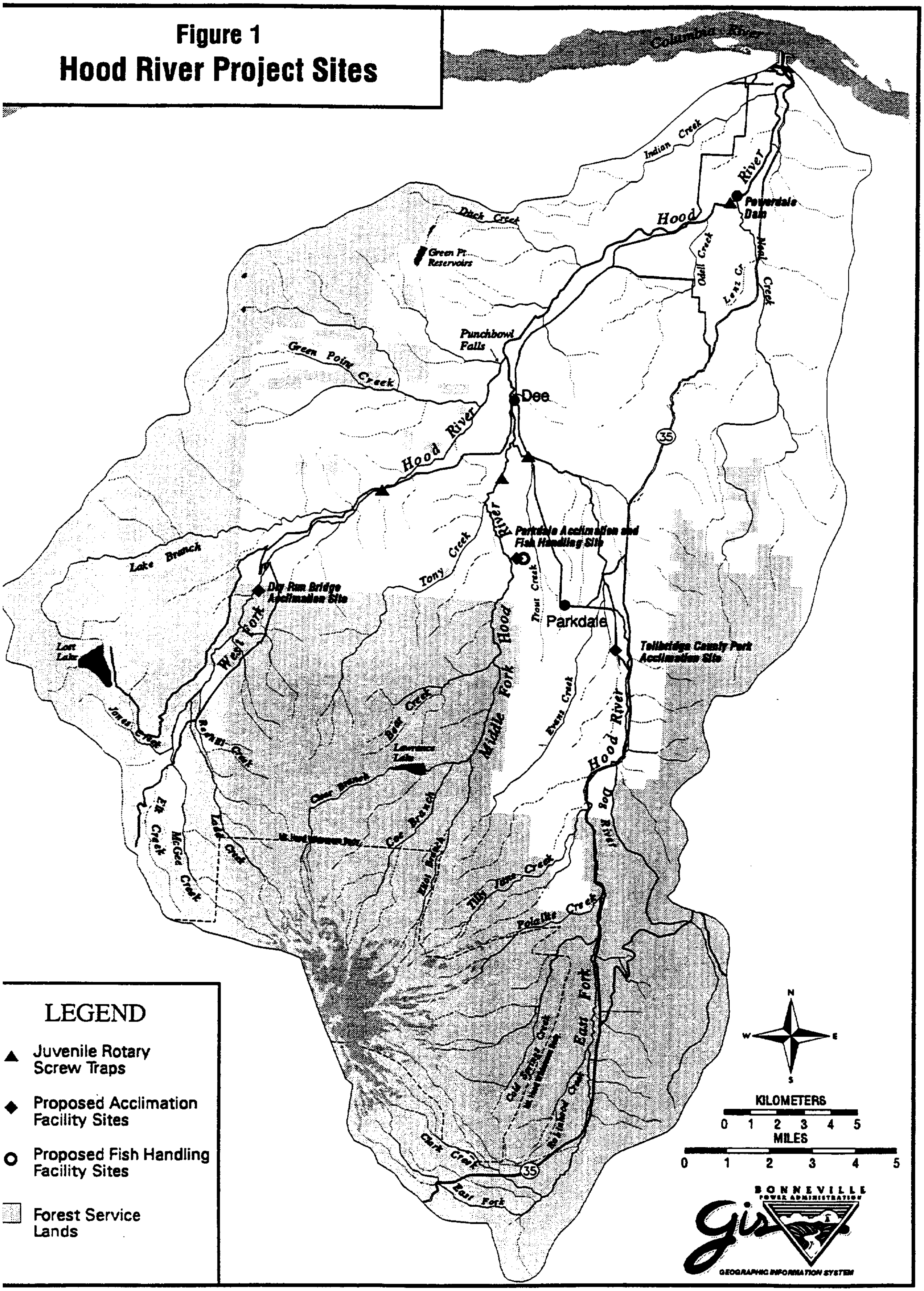
Prior to the release in 1996, all hatchery winter steelhead and spring chinook salmon were released into the Hood River subbasin without acclimation. The target hatchery production goal for the HRPP. during phase one of the project, was 125,000 spring chinook salmon smolts. Juvenile hatchery spring chinook salmon have been reared at Round Butte Hatchery (RBH) since the 1993 brood. Prior to the 1993 brood, spring chinook salmon juveniles were reared at Bonneville Hatchery. The numbers of hatchery spring chinook salmon (Deschutes River broodstock) smolts released into the West Fork Hood River were 46,445 (1991 brood year) and 170,004 (1993 brood year). No spring.chinook smolts were released into the Hood River subbasin from the 1992 brood (Report A, Table 66).

The target hatchery production goal for the HRPP, during phase one of the project, was 50,000 winter steelhead smolts. The numbers of hatchery winter steelhead (Hood River broodstock) smolts released into the East Fork Hood River ranged from 38,034 to 48,985 smolts for the 1992-1994 broods (Report A, Table 65). Juvenile hatchery winter steelhead (Hood River broodstock) are reared at OSH.

Study Site

Two acclimation and release sites were established within the Hood River subbasin (Figure 1). One portable raceway for winter steelhead smolts was located at Toll Bridge County Park on the East Fork Hood River (Rm 6.0) and two portable raceways for spring chinook salmon smolts were located near Dry Run Bridge on the West Fork Hood River (Rm 9.0).

Figure 1
Hood River Project Sites



East Fork Hood River

Three portable raceways were purchased from ModuTank, Inc. Each raceway had dimensions of 11'9" x 49'3" x 4'9" and had a capacity of 19,500 gallons of water. Raceways were constructed of four foot galvanized steel panels bolted together, "L" braces and stainless steel cables for support, a 36 mil reinforced polypropylene liner and a six inch PVC flange for draining the raceway. Figure 2 shows the portable raceway used to acclimate winter steelhead smolts in the East Fork Hood River. This type of portable raceway was used successfully by ODFW on the Siuslaw River (Lindsay et al. 1991-1994).

The raceway was assembled at Toll Bridge County Park along side the East Fork Hood River (Figure 3). This site was chosen because it was close to preferred winter steelhead habitat and it required minimal site preparation.

Figure 2. The East Fork Hood River portable acclimation raceway.

Including help from volunteers, total set-up was 100 hours. As part of set-up an underground power line was run directly to the site to provide electricity for two 400 gal/min sump pumps and a camp trailer. During acclimation, water was pumped into the acclimation raceway at 700 gal/min. Once the raceway was erected, a four foot high, six inch diameter PVC standpipe was connected to the outlet flange to control the water level inside the raceway. The pipe was also used to release fish and to drain the raceway when needed. Approximately 70 ft of pipe, six inches in diameter, was used for the outlet back to the East Fork Hood River. The raceway was covered with a fine mesh net to prevent fish from jumping out and to protect them from.predators.

A battery operated flotation alarm system was attached to the raceway during acclimation (Figure 4). The alarm system sounded when the water level increased (plugged screen from fish mortalities or debris) or decreased (lack of water from the pumps). The contact points of the alarm could be adjusted to regulate water depth variation during acclimation. The float consisted of a 4'6" dowel with a Styrofoam float attached to the bottom. A rain gutter drain encompassed the float, protecting and regulating it from waves in the pond created by wind.

Radio communication for the East Fork and West Fork acclimation sites was provided by Columbia River Inter-tribal Fisheries Enforcement (CRITFE). Portable hand-held radios were provided at both locations and a radio repeater was installed on Middle Mountain, within the Hood River subbasin. Tribal staff communicated between acclimation sites and with the CRITFE dispatch 'center in Hood River.

Approximately 51,000 smolts at 5.3 fish/lb were scheduled for release into the East Fork Hood River. The first group of 25,057 winter steelhead smolts were transported from OSH from l-4 April, 1996 to the Toll Bridge acclimation site. They were released volitionally between 12-22 April. Approximately 2,000 fish failed to emigrate. These fish were left to acclimate with the second group. The second group of 26,965 winter steelhead smolts arrived between 22-24 April and were held until their volitional release between l-8 May. Loading in the raceway at the time of transfer was 6.5 lbs/gpm (1.8 lbs/cu ft) for group one and 8.3 lbs/gpm (2.3 lbs/cu ft) for group two.

Smolts were volitionally released from the portable raceway and standpipe utilizing a new technique in acclimation. An aluminum hopper (or funnel) was constructed. with a rectangular "V" shaped bottom, three vertical sides, one open side and the "V" bottom connected to a six inch diameter pipe (Figure-5). A V-shaped bottom allowed at least three inches of water to filter into the standpipe. The hopper dimensions were approximately two ft square by one ft high. During the volitional release, one section of standpipe was

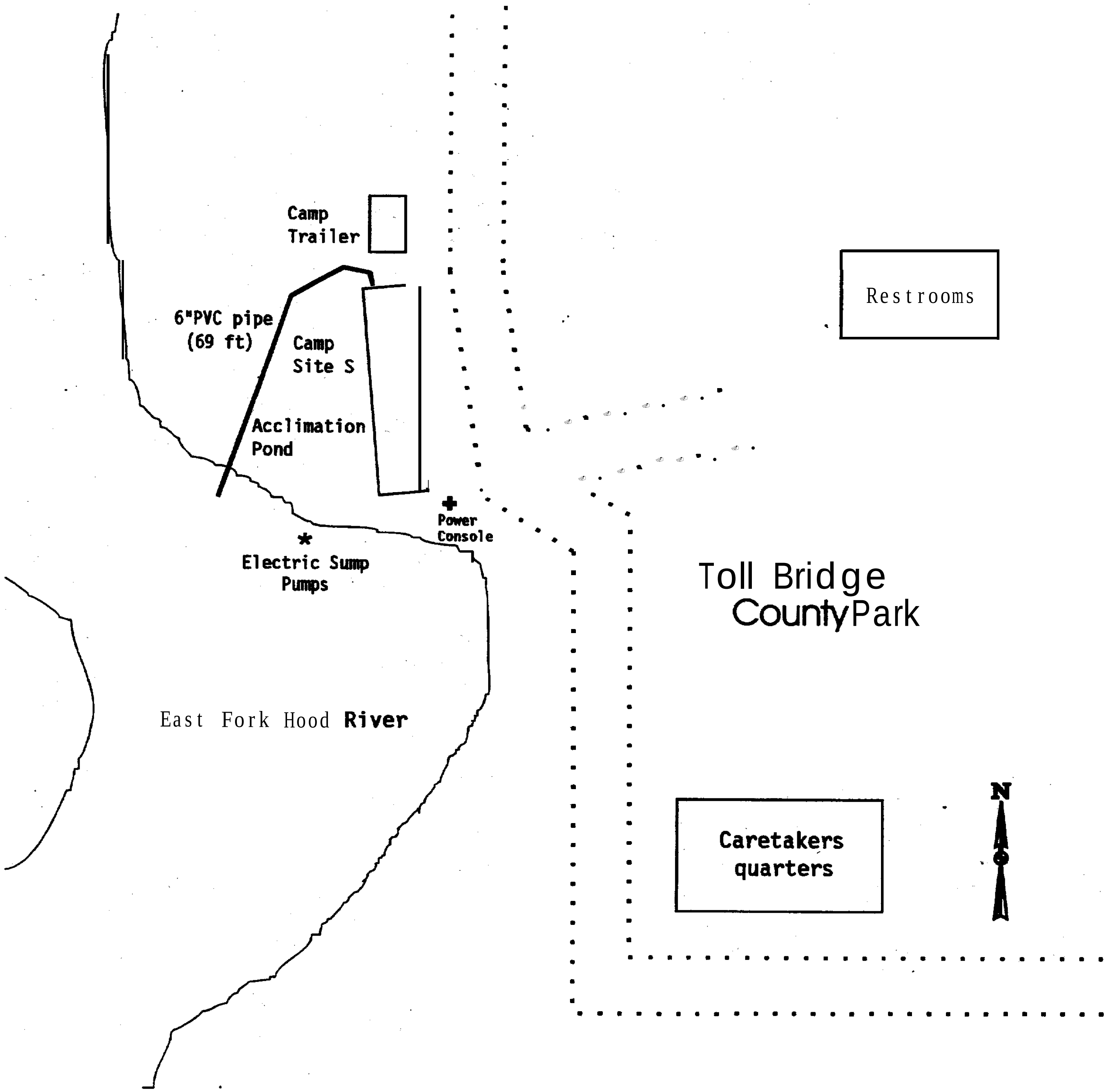


Figure 3. East Fork Hood River acclimation site located at Toll Bridge County Park.

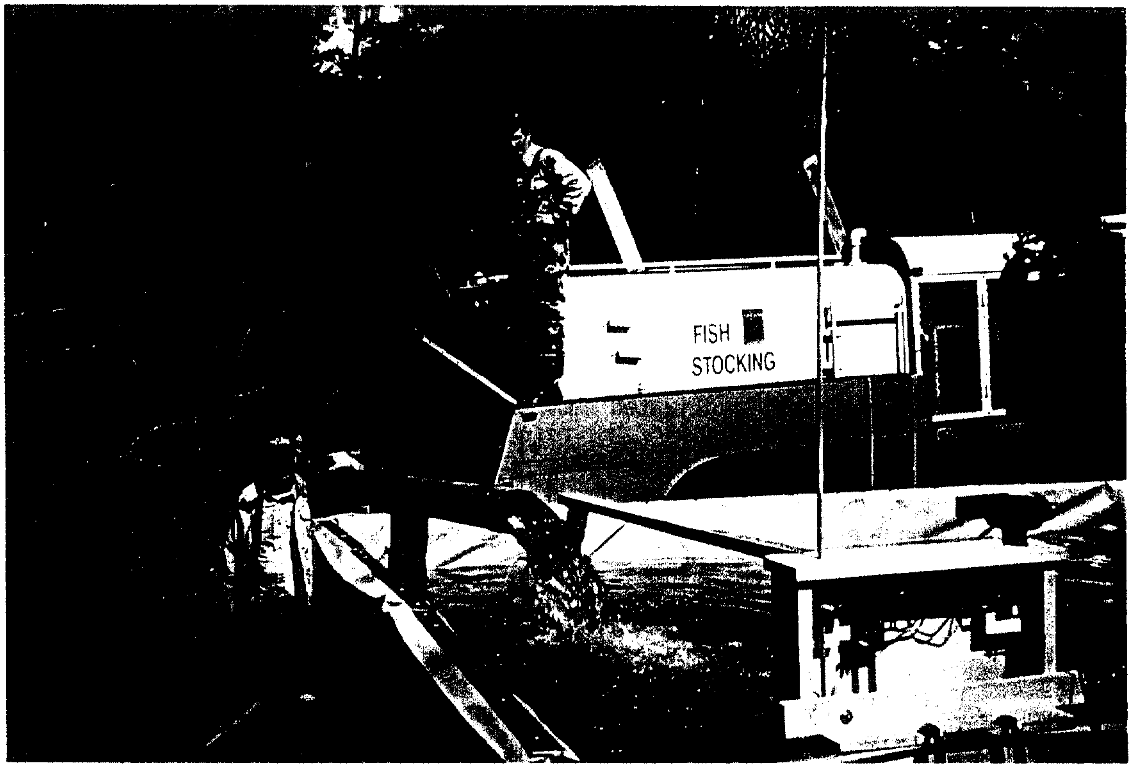


Figure 4. The flotation alarm system used during acclimation is located in the bottorr right corner. Also shown is the hatchery truck unloading winter steelhead into the acclimation raceway.

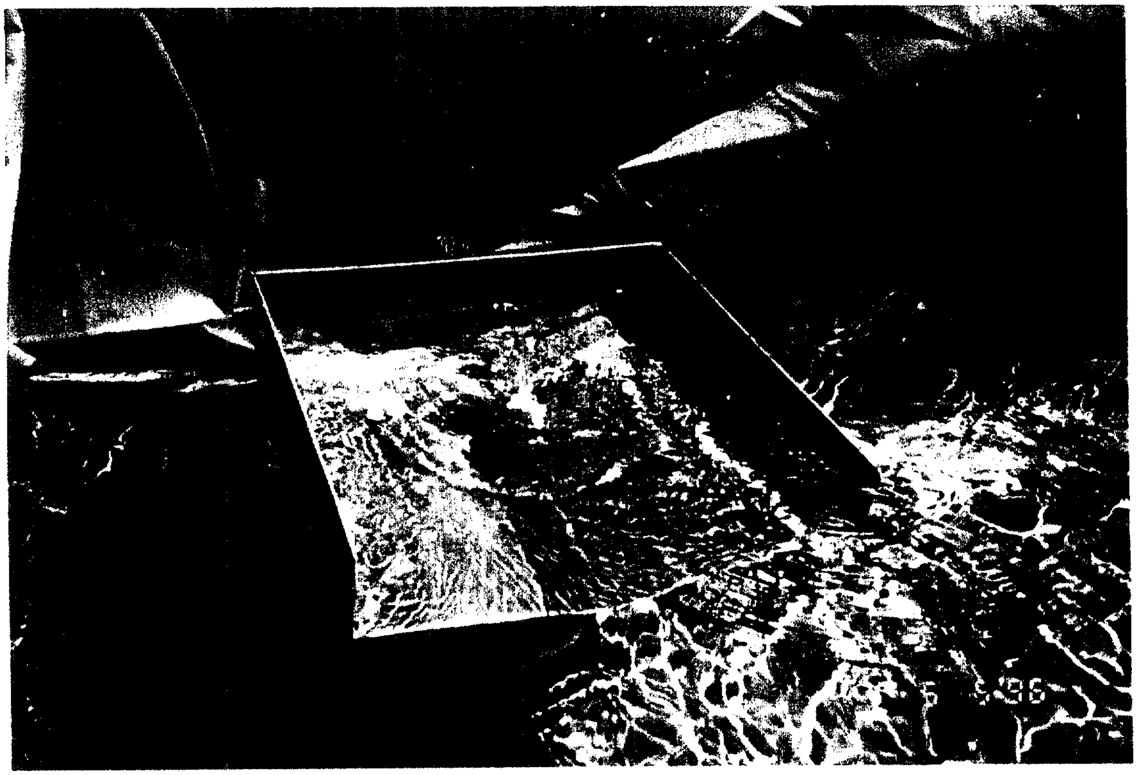


Figure 5. The hopper used in volitional fish releases at the East Fork and West Fork acclimation sites.

removed to lower the water level in the raceway to approximately a three ft depth. The hopper was placed on top of the remaining standpipe so that the opening to the standpipe was enlarged and provided easier fish emigration.

After the second release the number of remaining winter steelhead was estimated by weighing all winter steelhead and determining fish per pound. Winter steelhead were weighed (g) and measured (mm) and condition factors (weight [g] x 100/length^3 [mn]) were calculated prior to and after acclimation. Post-acclimated smolts were sampled at a rotary screw trap by ODFW at Rm 4.0 on the mainstem Hood River (Figure 1). To minimize residualism in the East Fork Hood River, remaining winter steelhead smolts were released at Rm 0.5 on the mainstem Hood River, thus limiting competition between hatchery-reared and wild salmonids in the Hood River subbasin.

An acclimation caretaker was on site 24 hr/d. The acclimation caretaker monitored water temperatures and dissolved oxygen, checked water supply and water level in the pond, picked and enumerated mortalities, and fed winter steelhead smol ts (APPENDIX A). Winter steelhead smolts were fed as much as they would consume of X4 Bio Moist pellets during afternoon hours, but were taken off feed three days prior to release.

Once hatchery winter steelhead smolts left the acclimation pond their outmigration timing was monitored and smolt survival was estimated and compared to smolts produced in the wild. Downstream migrant anadromous salmonids were trapped by ODFW using a rotary screw trap located on the mainstem Hood River [Rm 4.0) (Figure 1). All trapped fish were anesthetized, sorted by species, examined for fin marks, and counted. ODFW used mark and recapture methods to estimate the abundance of wild, natural, and hatchery produced anadromous salmonid smolts that migrated from the Hood River subbasin. A pooled Peterson estimate with Chapman's modification was used to estimate numbers of downstream migrants by species (Olsen et al. 1996).

Outmigration timing was based on daily numbers at the migrant trap which were extrapolated using biweekly wild trapping efficiency numbers (Appendix Table A-3). The trapping efficiency number (60%) for 16-30 April was not used because it only represented 5 marked fish. Trapping efficiency for 16-30 April was calculated using a ratio comparison of hatchery and wild trapping efficiency numbers between 1-15 April and 1-15 May and comparing it to the time period 16-30 April (Appendix Table A-3). River conditions were similar during this time period.' In addition, smolt outmigration survival from the acclimated smolts was compared to non-acclimated smolts from previous releases.

Electrofishing surveys were performed in the East Fork and nearby tributaries to evaluate residualism of hatchery winter steelhead releases (Report A, Figure 3). A three pass and two pass removal method was used to estimate population numbers (Report A, Methods).

West Fork Hood River

An old rock quarry site near Dry Run bridge on the West Fork Hood River was chosen for acclimating spring chinook salmon smolts. This location is near the preferred spawning and rearing habitat of spring chinook salmon in the Hood River system. Water quality and quantity in the West Fork is considerably better than in the East Fork because it is not influenced by glacial runoff or irrigation withdrawal. However, the West Fork is in a remote canyon with no electricity making acclimation set-up extremely difficult. Land ownership included both a private landowner and the US Forest Service (USFS) and required special use permits from both groups. A permit was also required from the Hood River County.

Assembly of two ModuTank portable raceways began in March and took over 700 h (Figure 6). Unlike the East Fork raceway, water to the West Fork raceways was supplied through a screened head box and a 930 ft gravity flow pipeline diverted from Blackberry Creek, tributary of the West Fork. The head box dimensions were 2'6" x 2'5" x 1'9". There was about 38 ft of head differential between the intake box and the raceways. This provided 351 gal/min of water into the east raceway (raceway 1) and 401 gal/min into the west raceway (raceway 2). Figure 7 shows a detailed diagram of facilities at the West Fork Hood River acclimation site.

In addition, about 360 ft of pipe was used for the return flow back to the West Fork Hood River. Control valves regulated water at the head box, the junction of the two raceways, and at each raceway outlet. An elaborate bracing and support system for the pipeline took much of the assembly time. The base for the ponds required considerable filling with gravel and sand, leveling and compacting. Both acclimation raceways were constructed as described for the East Fork acclimation site with bird netting, alarm systems, standpipes with screens, and a hopper attached to the standpipe when spring chinook salmon smolts were volitionally released. A caretaker was on-site 24 hr/d. Fish were fed a #4 Bio Moist diet but were taken off feed three days prior to release.

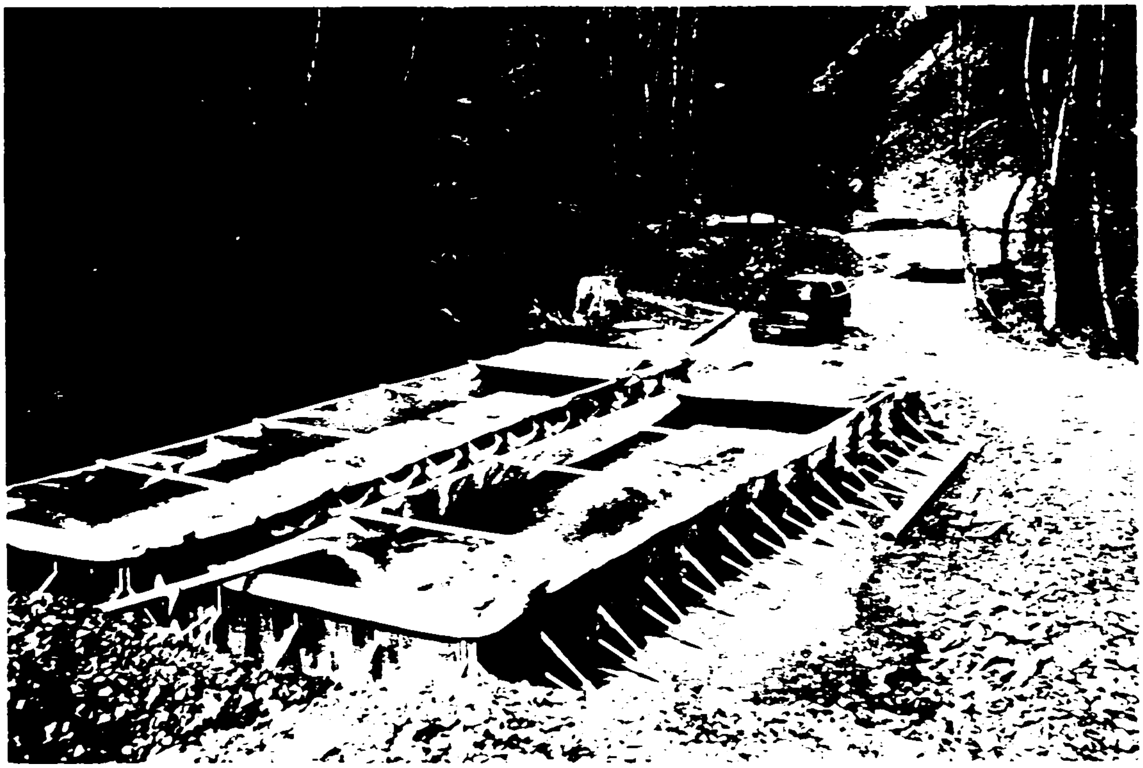


Figure 6. The accliration raceways used for rearing spring chinook salmon near the West Fork Hood River.

Approximately 129,918 Deschutes River stock spring chinook salmon molts averaging 9.9 fish lb were acclimated in the West Fork Hood River. Spring chinook salmon smolts were acclimated in two separate groups to keep loading at acceptable levels. The first group of 85,080 smolts was transported from Pelton Ladder rearing cell four to the West Fork acclimation raceways between 8-10 April, 1996. These smolts were allowed to volitionally emigrate from 15 April until 22 April, 1996. An estimated 2,000 fish per pond did not migrate. The second group of spring chinook molts (44,838) was hauled from Pelton Ladder rearing cell five Detween 22-23 April, i996. The second group, along with the remaining first group, was acciinated until 29 April, 1996, and volitionally released until 9 Yay.

Loading in the west raceway (raceway one) at tile of transfer was 10.6 lbs/gpm (1.6 lbs/cu ft) and 11.9 lbs/gpm (2.1 lbs/cu ft) in the east raceway (raceway two). For group two, loading in raceway one at tine of transfer was 10.6 lbs/gpm (1.6 lbs/cu ft) and 3.5 lbs/gpm (C.6 lbs/cu ft) in raceway two.

An estimated 2,000-3,000 fish per pond re-ained after acclimation and were forced out of the acclimation raceways into the West Fork Hood Giver on 9 May, 1996. Mean fork length (mm) and weight (g) were measured and condition factors (weight [g] x 100/length^3 [mm]) calculated fcr the re-airing spring chinook salmon smolts prior to being forced out of the

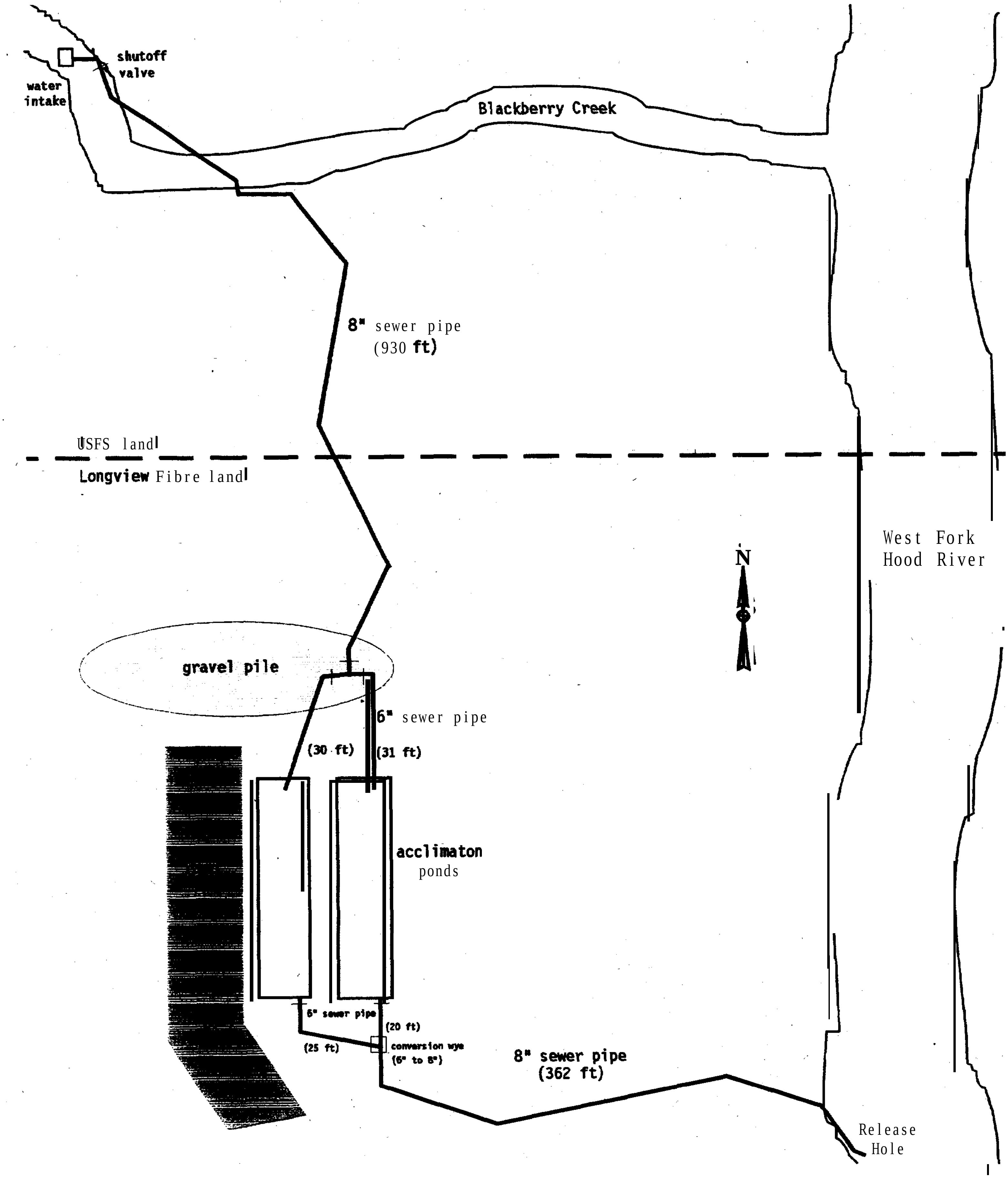


Figure 7. Schematic of the West Fork Hood River acclimation site (Rm 9.0) located near Dry Run bridge.

acclimation raceways.

Dissolved oxygen, water temperatures, and mortalities were recorded daily during acclimation (APPENDIX **B)**. Once hatchery spring chinook salmon smolts left the acclimation raceways, their outmigration timing was graphed and compared to smolts produced in the wild. Downstream migrant anadromous salmonids were trapped by ODFW using a rotary screw trap located on the **mainstem** Hood River [Rm **4.0]** (Figure **1)**. Outmigration timing was based on daily counts at the migrant trap and not adjusted for trapping efficiency.. Low numbers of naturally produced spring chinook salmon smolts and poor survival of hatchery smolts from handling, resulted in no trapping efficiency for spring chinook salmon smolts.

Electrofishing surveys were performed in the West Fork and nearby tributaries to evaluate residualism of hatchery spring chinook salmon releases (Report A, Figure 3). A three pass and-two pass removal method was used to estimate population numbers using electrofishing surveys (Report A, Methods). A distribution snorkel survey was conducted in the West Fork Hood River on 12 September near the acclimation release site. Three passes were made by one snorkeler and a count was **accumulated** each pass. Visibility was 5-7 feet. Three pools were snorkeled below the acclimation release site, one pool was located at the release site, and one pool was snorkeled above the release site.

Results and Discussion

East Fork Hood River

A total of 51,022 Hood River stock hatchery winter steelhead smolts were acclimated, of these an estimated 44,916 smolts emigrated volitionally, '5,988 remained in the raceway and were trucked to Rm 0.5 and released, and 118 died in the raceway. Group 1 was acclimated between 9-12 days and group 2 was **acclimated** between 8-10 days before release (Table 1).

ODFW. with the use of a rotary screw trap (Rm **4.0)**, estimated that 33,612 or 73.3% of the volitionally released hatchery winter steelhead passed the trap. Estimates of 1994 and 1995 trap catches of unacclimated hatchery winter steelhead were 32.1% and 38.1% respectively (Report A, Table 67).

Reduced stress from acclimation following transportation via a hatchery truck may have increased smolt outmigration by reducing mortality caused from stress. Studies have shown with **coho** salmon ***(O. kisutch)*** (Schreck et al. 1989) and steelhead (0. ***mykiss)*** (Whitesel et al. 1994) that stress from transportation via hatchery truck can cause a marked physiological stress response. Schreck (1989) also found "fish not given adequate time to recover from the transport stress were less capable than unstressed fish of surviving in the wild".

Table 1. Numbers of Hood River hatchery winter steelhead acclimated in a portable raceway in the East Fork Hood River drainage, 1996.

Location	Species[a]	Date transferred to raceway	Number transferred to raceway	Fish/lb	Number of days acclimated	Mortalities	Number[b] released
East Fork							
Group 1	STW	Apr 1-4	24.057	5.7	9-12	24	24.033
Group2	STW	Apr 22-24	26.965	5.0	8-10	94	26.871

[a] STW = winter steelhead.

[b] Df the total 50,904 acclimated winter steelhead molts released, an estimated 5.988 were hauled and released at Rm 0.5 on the mainstem Hood River and 44,916 emigrated volitionally.

Furthermore, Viola and Schuck (1995) stated, "to prevent the emigration of fish that are likely to residualize does substantially reduce the number of nonmigrant hatchery-reared steelhead and thus reduces the frequency of negative interactions between'these fish and wild salmonids". Our action of not forcing non-migrant acclimated hatchery winter steelhead smolts to leave the acclimation raceway biases our results in favor of increased survival of migrants (Report A, Table 67). However, the number of non-migrants that were transported and released at Rm 0.5 were only 11.8% of the total number of fish. If these fish had been forced out of the acclimation raceway and residualized, the relative percentage of 1996 fish migration would have only changed 8.8%. but not enough to change the overall results of a much higher smolt outmigration in 1996 (Report A, Table 67).

Size at release has varied yearly for hatchery winter steelhead smolts. Winter steelhead smolts averaged 5.9 fish/lb in 1994, 5.4 fish/lb in 1995, and 5.3 fish/lb in 1996. In addition, 1996 acclimated winter steelhead smolts varied between release groups. Group I averaged 5.7 fish/lb and group 2 was 5.0 fish/lb (Table 1). In past years releases, group 2 had been smaller in size than group 1 (Olsen et al. 1996). Typically, hatchery winter steelhead at OSH are graded into two size groups, medium (Group 2) and large (Group -1). The two groups are reared in separate raceways at OSH. This allows hatchery personnel to apply a modified feeding schedule targeting the smaller juveniles in the production group. The modified feeding schedule allowed hatchery personnel ability to accelerate the growth of smaller juveniles so that the entire production group is more uniformly sized upon transfer to the Hood River subbasin. To keep the poundage at acceptable levels in the acclimation raceways, winter steelhead smolts are acclimated in two groups. The larger fish (Group 1) are acclimated first, followed by the smaller fish (Group 2). Group 2 remained at OSH on the modified feeding schedule for an additional three weeks, eventually outgrowing group 1 fish.

Hatchery winter steelhead smolts were volitionally released starting 12 April and 1 May. The 1996 migration timing of hatchery winter steelhead and wild rainbow/steelhead smolts to the mainstem Hood River rotary screw trap (Rm 4.0) is'presented in Figure 8. The median date of arrival at the mainstem rotary screw trap for hatchery winter steelhead was 9 May compared to 19 May for wild rainbow/steelhead. The outmigration timing of hatchery winter steelhead smolts and wild rainbow/steelhead juveniles appear similar following an initial peak in hatchery smolt outmigration from acclimated releases. The mainstem Hood River rotary screw trap was not operated between 23 April-l May.

No hatchery winter steelhead smolts were recovered while electrofishing the East Fork Hood River tributaries during 1996 sampling (Report A, Appendix Table A-l). An attempt to electroshock portions of the East Fork Hood River failed because of higher flows. In 1994 and 1995 hatchery winter steelhead were sampled at Rm 0.5 and 5.5 on the East Fork Hood River. In addition, hatchery steelhead smolts were recovered in Neal Creek (tributary to the mainstem Hood River) in 1994 sampling (Olsen et al. 1996).

The condition factor for volitional migrants averaged 0.97 versus 1.0 for non-migrants (Table 2).

Table 2. Mean condition factors for hatchery winter steelhead volitional migrants collected in the mainstem Hood River juvenile rotary screw trap and non-migrants trucked to the mouth of the Hood River.[a]

Group	N	Mean	Range	95% C.I.
Volitional migrants	327	0.97	0.80 - 1.28	± 0.01
Non-migrants	207	1.00	0.84 - 1.15	± 0.01

[a] Condition factor was estimated as (weight [g] * 100/length^3 [mm].

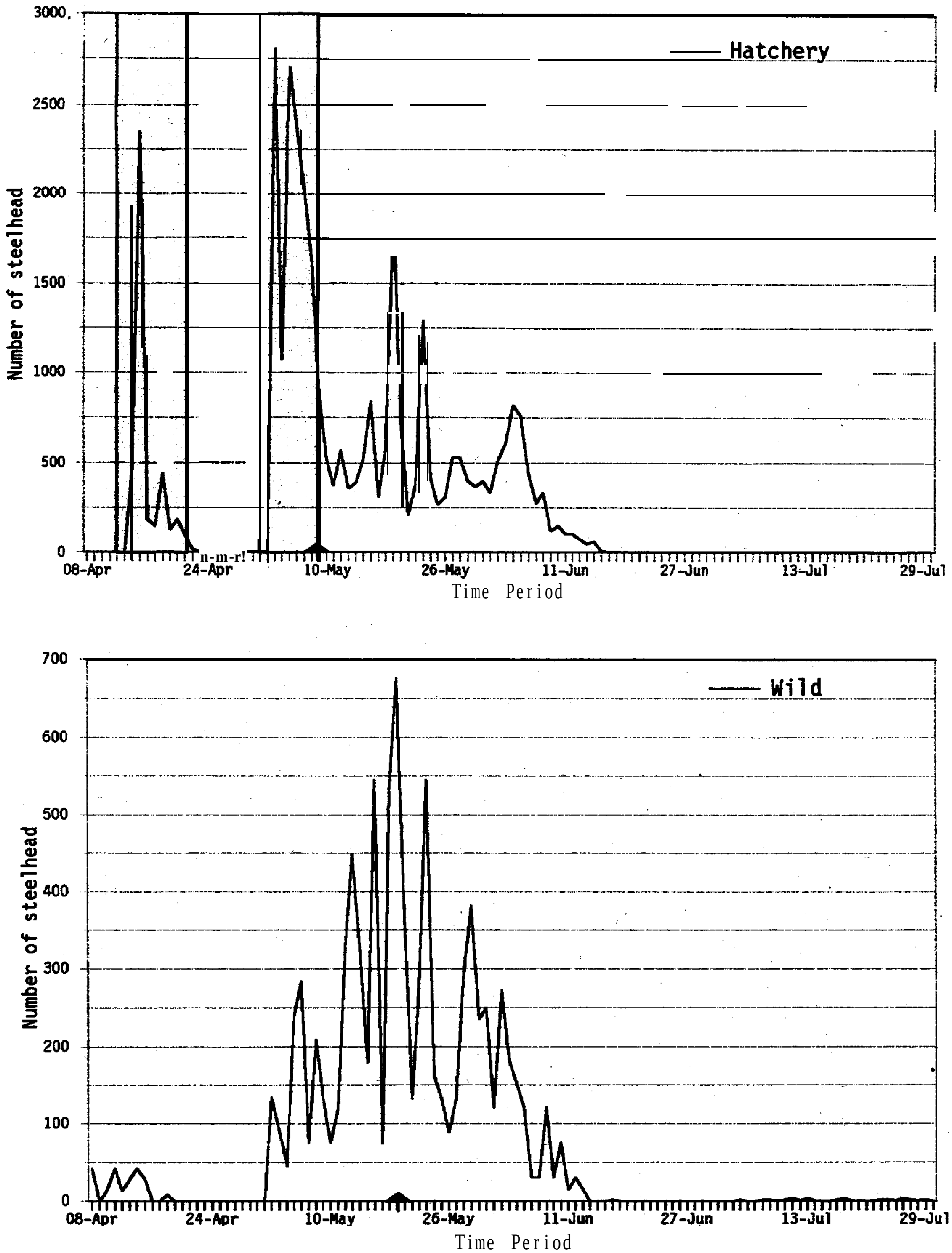


Figure 8. Migration timing of hatchery winter steelhead and wild rainbow/steelhead at the **mainstem** Hood River rotary screw trap, 1996 migration year. The trap was not operational between 23 April-1 May. Numbers were adjusted for trapping efficiency. A = median migration date. The shaded portion represents timing of volitional releases from the East Fork Hood River acclimation raceways.

West Fork Hood River

A total of **129,918** Deschutes River stock hatchery spring chinook salmon smolts were acclimated, and of these an estimated 123,211 emigrated volitionally. Approximately 6,000 **smolts** did not emigrate and were forced out of the raceways at the end of acclimation. An estimated 707 smolts **died in** the raceways. Hatchery spring chinook salmon **smolts** in group 1 were acclimated 6-8 days and 7-8 days in group 2 prior to release (Table 3).

Table 3. Deschutes River stock spring chinook salmon acclimated in portable raceways in the West Fork Hood River drainage, 1996.

Location	Species[a]	Date transferred to raceways	Number transferred to raceways	Fish/lb	Number of days acclimated	Mortalities	Number released
West Fork							
Group 1	CHS	Apr 8-10	85,080	10.0	6-i	180	84,900
Group2	CHS	Apr 22-23	44,838	9.5	7-8	527	44,311

a. CHS = spring chinook salmon.

Hatchery spring chinook salmon smolts were volitionally released starting **15** April and 29 April. Figure 9 shows a **peak** in smolt outmigration directly after each release from the acclimation ponds. When the ponds were lowered one foot to begin the volitional release, **smolts** began moving out **immediately.** An estimated 50,000 **smolts** moved out of the raceways within the first 16 hours of the first release. Within 24 hours, hatchery smolts began showing up at the **mainstem** Hood River juvenile rotary screw trap (Rm **4.0),** a **distance** of 17 miles. However, because of the mass migration, the trap was not operated between 23 April-l May and consequently no estimate was collected for the number of spring chinook salmon **smolts** that left the subbasin. 'Very few (22 total) wild spring chinook salmon smolts were captured in the **mainstem** screw trap.

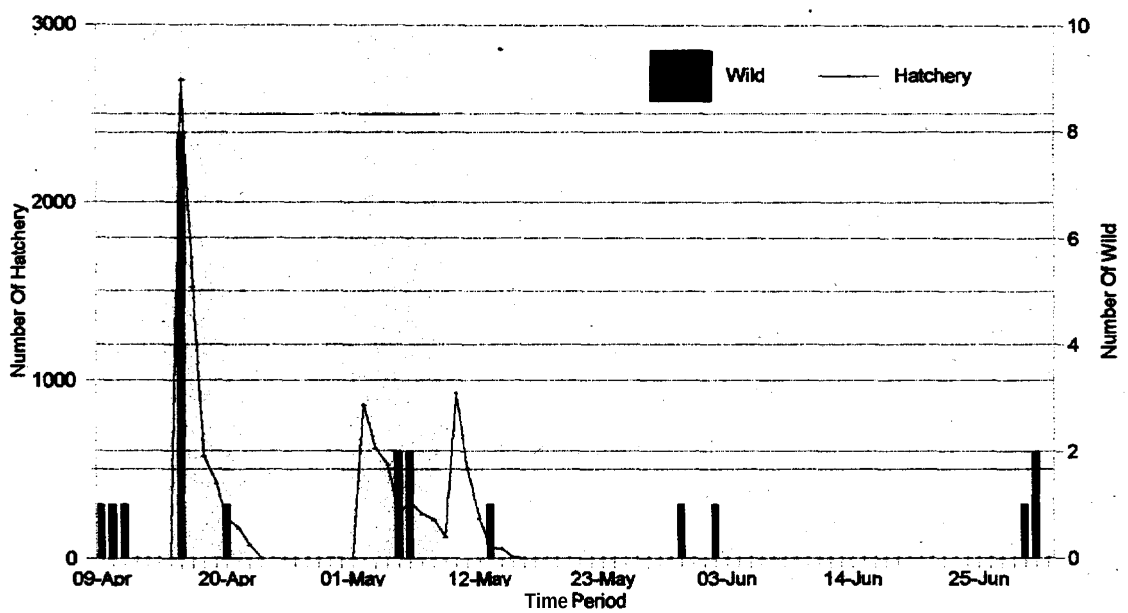


Figure 9. Migration timing of hatchery and wild spring chinook salmon smolts at the mainstem Hood River rotary screw trap, 1996 migration year. Trap was not operational between 23 April-1 May. Numbers were not adjusted for trapping efficiency. The shaded portion represents the timing of the volitional release from the West Fork Hood River acclimation raceways.

No hatchery spring chinook salmon smolts were recovered electrofishing the West Fork Hood River tributaries during 1996 sampling (Report A, Appendix Table C-1). Higher flows in the West Fork Hood River mainstem prevented HRPP staff from electroshocking. No hatchery spring chinook smolts were seen when carrying out snorkel surveys near the West Fork Hood River acclimation release site (Table 4).

Table 4. Number of hatchery spring chinook salmon and summer steelhead smolts counted during snorkel surveys on the West Fork Hood River, 12 September.

Location, year	Pool one	Pool two	Pool three	Pool four	Pool five[a]
West Fork,					
1996,					
HCHS	0	0	0	0	0
HSTS	5	2	1	0	2

[a] This was a deep pool and was difficult to snorkel with one person. On each pass the same number of hatchery summer steelhead was counted. Visibility was moderate.

Recamendations

The East Fork acclimation site should be moved from Toll Bridge County Park to the East Fork Irrigation District (EFID) ditch sand trap. The EFID has donated the use of the sand trap and will be a cost benefit for the HRPP by eliminating yearly setup costs at Toll Bridge County Park. One sand trap raceway (permanent) will be'modified with a screen and stop log system to acclimate winter steelhead. CTWS will continue to acclimate and volitionally release winter steelhead in two separate groups.

Winter steelhead and spring chinook smolts that do not volitionally migrate should be differentially marked and forced out of the acclimation raceways. The potential impact of forcing out non-volitional **smolts** should be evaluated.

RADIO TELEMETRY

Introduction

A study to assess the upstream migration of adult salmonids in the lower Hood River was conducted from 1 June through 16 November, 1995 and 28 May through 27 November, 1996. The lower Hood River radio telemetry study was a joint effort by the CTWS, ODFW, and PacifiCorp. There were three objectives to this study: (1) document migration of adult spring chinook salmon, fall chinook salmon, and summer steelhead in the lower Hood River; (2) monitor the possible effects of streamflow in the bypass reach and the powerhouse tailrace on fish migration; and (3) document fish movement through the fish ladder at Powerdale Dam (Copper Dam) and into the upper subbasin. ODFW continued to radio track these fish throughout spawning in the upper Hood River subbasin in 1995.

PacifiCorp became involved in the radio telemetry study as part of the relicensing process for the Powerdale Project. The Federal Energy Regulatory Comnission (FERC) issued the Powerdale Project license on 14 March, 1980. The license is effective for a period from 1 April, 1962 to 1 March, 2000. The FERC regulations specify a minimum 5-year, 3-stage consultation process for the preparation, filing, and processing of a new license application for an existing hydroelectric project. During the first stage of consultation, agency and tribal representatives expressed concern that PacifiCorp's operations may be effecting anadromous adult passage through the bypass reach ((powerhouse (Rm 1.0) to the diversion dam (Rm 4.0)), causing fish to delay at the powerhouse tailrace. Furthermore, ODFW and CTWS expressed concerns about the adequacy of the fish ladder (PacifiCorp 1995). In 1995, PacifiCorp entered into a cooperative radio telemetry study with CTWS and ODFW to address these concerns.

Powerdale Dam is located at Rm 4.0 on the mainstem Hood River. Constructed of concrete, it is approximately 22 ft in height with a sloping apron and a concrete fish ladder on the eastern bank. The dam diverts a portion of the river flow (500cfs) to a powerhouse located approximately 3.2 mi downstream.

Adult fish passage over Powerdale Dam has generally been considered adequate. Fish can, however, be falsely attracted to flows passing over the dam spillway or through the trash chute at the dam's western end (O'Toole and ODFW, 1991a) thereby making it difficult for adult fish to find the ladder entrance. In 1995, continued observations of steelhead jumping at the spill from the dam indicated there were fundamental problems with a new ladder entrance configuration constructed by PacifiCorp in 1994 (Nelson, unpublished data, 1996). Minor modifications were made in attempt to help adult fish find the ladder entrance with mixed results. The consensus among all agency managers involved in the management of the Hood River and PacifiCorp was that additional structural changes to the fishway and attraction water system were necessary. Work began in December, 1995, to reconfigure the auxiliary attraction water.

Study Site

Radio telemetry work was conducted on the lower Hood River from the mouth to the Powerdale Diversion Dam (Rm 0.0-4.0). The primary objectives were to evaluate delay at the powerhouse tailrace (Rm 1.0), migration through the bypass reach (Rm 1.0-4.0), and delay at the Powerdale Diversion Dam (Figure 10).

Methods

Spring chinook salmon, fall chinook salmon, and summer steelhead were captured at the Powerdale Dam fish trap; anesthetized with carbon dioxide; identified; sexed; measured (cm); and weighed (kg). An Advanced Telemetry Systems@ (ATS) radio transmitter was orally -inserted into the fishes gut cavity, just past the esophagus, using a small PVC pipe as a guide. The transmitters operated between 40 and 41 MHZ frequencies and each transmitter had an unique frequency so individual fish could be tracked. Two floy tags were inserted below the dorsal fin of each'radio-tagged adult fish. Floy-tagging allowed visual identification of the adult fish if they had regurgitated the radio-tag before reentering the fish ladder. Adult fish were collected randomly throughout the entire run. In I995, 10 spring chinook salmon and 26 summer steelhead were radio-tagged. In 1996, 12 spring chinook salmon, 1 fall chinook salmon, and 37 summer steelhead were radio-tagged.

All radio telemetry study fish were transported downstream in a portable liberation tank and released at Rm 0.5 (lower railroad crossing). The chosen release site provided good truck access and helped prevent further delay of fish migration and straying from the Hood River subbasin into the Columbia River.

Radio-tagged spring chinook salmon, fall chinook salmon, and summer steelhead were monitored daily from the mouth of the Hood River to the diversion dam by either CTWS or PacifiCorp. A hand-held receiver and directional antenna was used to locate radio-tagged fish. Landmarks were established every 0.1 mi from the mouth to Powerdale Dam using a hip chain for measurement. The locations of each fish was recorded daily on data forms *to* the nearest unit of stream.

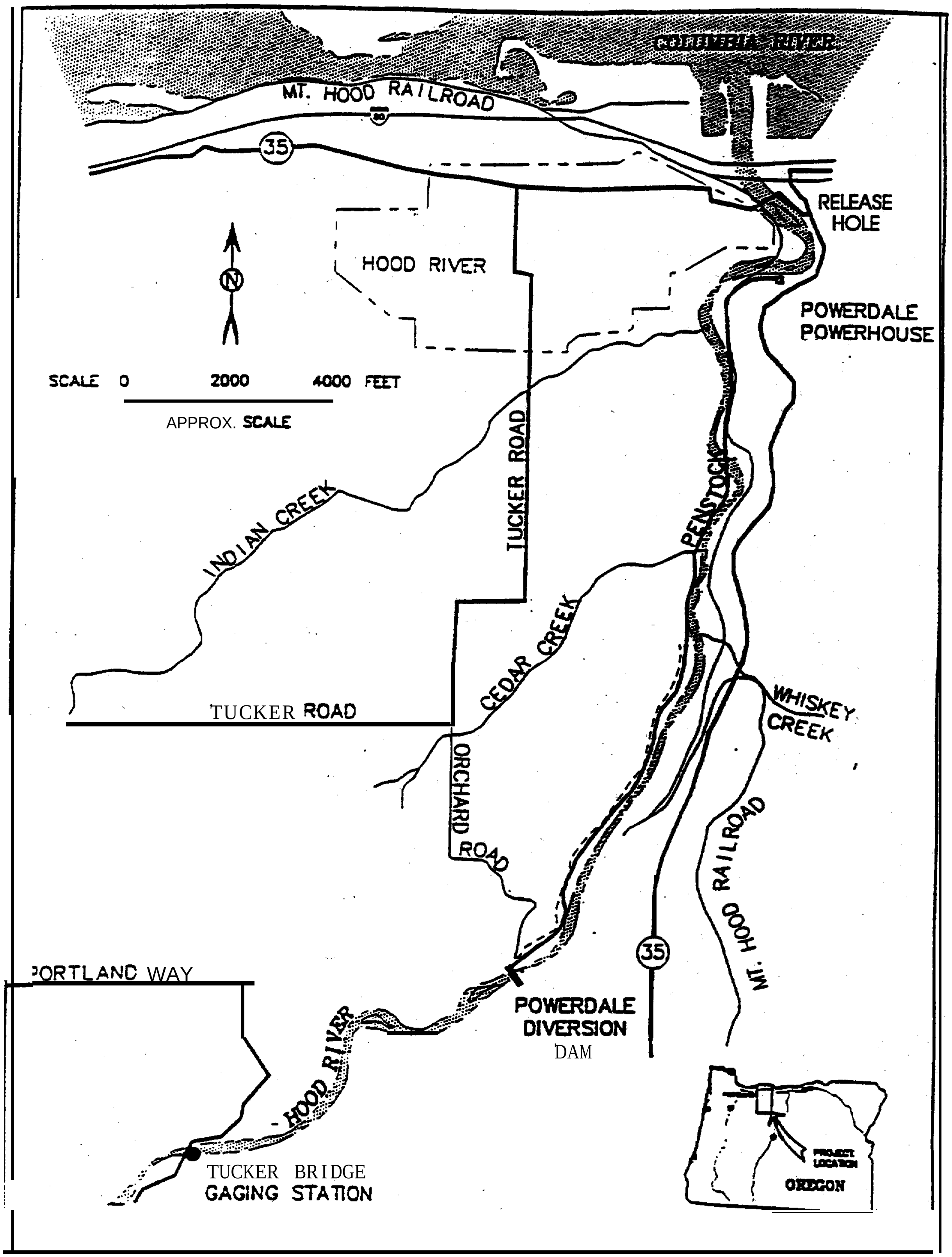


Figure 10. The Hood River below Powerdale Diversion Dam (Rm 4.0).

Table 5. Fish classifications, tag frequencies, and date information for radio-tagged spring chinook salmon in the Hood River. 1995-96.

Study Year, Fish classification, Tag frequency.	gate tagged	Date passed	gate lost	Study ending date
1995,				
Passed.				
41.592	06/03/95	07/09/95		
41.532	06/26/95	08/16/95		
Lost,				
41.622	06/04/95		09/03/95	
41.612	07/10/95		07/24/95	
Active,				
41.511	05/31/95			10/11/95
41.602	06/03/95			10/11/95
41.662	06/04/95			10/11/95
41.682	06/05/95			10/11/95
41.482	06/10/95			10/11/95
41.542	07/03/95			10/11/95
19%.				
Passed,				
41.370	05/30/96	06/22/96		
40.650	06/01/96	06/07/96		
40.681	06/03/96	07/02/96		
41.060	06/08/96	07/04/96		
Lost,				
41.3%	05/30/96		06/27/96	
40.669	06/01/96		06/18/96	
41.401	06/02/96		07/29/96	
40.671	06/03/96		07/02/96	
40.6%	06/04/96		06/04/96	
41.0%	06/11/96		06/12/96	
Active,				
41.020	06/02/96			10/11/96
41.050	06/05/96			10/11/96

Table 6. Fish classification, tag frequency, and date information for radio-tagged fall chinook salmon in the Hood River. 19%.

Study Year, Fish classification, Tag frequency	Date tagged	Date passed	Date lost	Study ending date
1996,				
Active,				
41.150	08/29/96			11/27/96

Table 7. Fish classifications, tag frequencies, and date information for radio-tagged summer steelhead in the Hood River. 1995.

Study Year, Fish classification, Tag frequency	Date tagged	Date passed	Date lost	Study ending date
1995,				
Passed,				
40.010	06/01/95	07/18/95		
40.030	06/02/95	07/03/95		
40.380	07/02/95	07/21/95		
40.612	07/02/95	08/03/95		
40.390	07/04/95	07/16/95		
40.460	07/16/95	08/14/95		
40.590	08/02/95	08/24/95		
40.640	08/07/95	09/10/95		
Lost,				
40.040	06/03/95		06/03/95	
40.050	06/13/95		07/20/95	
40.060	06/19/95		10/26/95	
40.370	06/26/95		06/26/95	
40.070	07/02/95		07/23/95	
40.430	07/02/95		07/18/95	
40.510	07/02/95		07/21/95	
40.362	07/03/95		07/29/95	
40.400	07/03/95		07/30/95	
40.352	07/04/95		07/21/95	
40.440	07/04/95		08/14/95	
40.460	07/19/95		07/29/95	
40.520	07/23/95		08/19/95	
40.530	07/24/95		08/11/95	
40.560	07/29/95		09/24/95	
Active.				
40.470	07/10/95			11/16/95
40.410	07/16/95			11/16/95
40.630	08/07/95			11/16/95

Table 8. Fish classifications, tag frequencies, and date information for radib-tagged **summer** steelhead in the Hood River. 1996.

Study Year. Fish classification, Tag frequency	gate tagged	Date passed	Date lost	study ending date
1996,				
Passed,				
41.382	05/28/96	06/26/96		
41.010	06/01/96	07/09/96		
41.040	06/03/96	07/17/96		
41.080	06/10/96	07/09/96		
41.120	06/17/96	07/08/96		
41.130	06/17/96	07/01/96		
41.140	06/24/96	07/05/96		
41.160	06/30/96	07/20/96		
41.120	07/08/96	07/28/96		
41.140	07/15/96	08/26/96		
40.681	07/21/96	08/01/96		
41.100	07/29/96	09/17/96		
41.110	08/04/96	09/13/96		
41.170	08/05/96	08/15/96		
41.150	08/11/96	08/28/96		
41.182	08/12/96	08/29/96		
41.202	08/17/96	09/17/96		
41.340	10/22/96	10/30/96		
41.100	10/29/96	11/15/96		
Lost,				
41.032	06/03/96		07/06/96	
41.260	06/04/96		06/04/96	
41.010	07/10/96		07/26/96	
41.080	07/10/96		08/06/96	
40.650	07/15/96		11/24/96	
41.040	07/21/96		08/18/96	
41.190	08/17/96		09/10/96	
41.210	08/31/96		09/03/96	
41.230	09/10/96		11/22/96	
41.252	09/28/96		10/25/96	
41.292	09/29/96		11/15/96	
41.300	10/05/96		11/14/96	
Active,				
41.220	08/26/96			11/27/96
41.270	09/28/96			11/27/96
41.310	10/05/96			11/27/96
41.321	10/12/96			11/27/96
41.330	10/13/96			11/27/96
41.110	10/29/96			11/27/96

On 1 July, 1996, a fixed station with a limited receiving range was **installed** at the powerhouse **tailrace** (Rm 1.0) using an ATS receiver and data logger to document fish movement within the **tailrace** vicinity (Appendix **Table B-l).** The logger was programned to scan for frequencies every 10 seconds and store data every 10 minutes. Every time a fish was **radio-**tagged, the frequency was added to the logger. The logger was checked approximately every 10 days and downloaded as necessary.(PacifiCorp 1996).

Radio-tagged spring chinook salmon (Table 5) fall chinook salmon (Table 6) and **summer** steelhead (Tables 7 & 8) were separated into three main categories for **summarizing** the data: 1) fish that were passed above the dam, 2) fish that were lost at some time during the study (caught by a fisherman, left the Hood River subbasin, or a malfunctioned tag), and 3) fish that were still active in the lower Hood River at the.end of monitoring.

Results

Spring **Chinook Salmon**

1995 Study **Results:** A total of 10 spring chinook salmon were radio-tagged between 31 May and 10 July, 1995 and monitored until 25 October, 1995. Of the 10 radio-tagged spring' chinook salmon, two (25% of radio-tagged spring chinook salmon not classified as lost) passed the fish ladder at Powerdale Dam and two were lost at studies end (Table 9). By 11 October, 1995, five of the six remaining spring chinook salmon still transmitting a signal below Powerdale Dam were felt to have died, either from pre- or post-spawning related mortality. The sixth radio-tagged spring chinook salmon (frequency 41.602 MHZ) showed movement until 25 October.

On average it took 43.5 days for the two spring chinook salmon that passed the ladder at Powerdale Dam (Rm 4.0) to migrate from the release site. Each of the ten radio-tagged spring chinook salmon reached the dam **(averaging** 13.6 days) during the study'period (Table **9).**

The ten radio-tagged spring chinook salmon spent 10 days per fish **in the** Hood River downstream of the **tailrace (Rm** 0.1 to 0.8) and five days per fish in the powerhouse **tailrace** vicinity **(Rm** 0.9 to 1.1) [Table **9].** Radio-tagged spring chinook salmon spent the majority of their time (66 days per fish) in the vicinity of Powerdale Dam **(Rm** 4.0). Typically, tagged spring chinook salmon would hold downstream of the **tailrace** and then migrate quickly to the upper area near Powerdale Dam (Figure **11).**

Table 9. Migrational patterns of radio-tagged spring chinook and fall chinook salmon in the lower Hood River (Rm 0.1-4.0), 1995-96. Table shows mean number of days spring chinook and fall chinook salmon were located downstream of the tailrace and within the tailrace vicinity, bypass reach, and Powerdale Dam; and mean number of days for fish to reach the dam. (Correction factors for unknown days are in parentheses)[a].

Race, fish classification; study year	n	Downstream of tailrace (Rm 0.1-0.8)	Tailrace vicinity (Rm 0.9-1.1)	Bypass reach (Rm 1.2-4.0)	Powerdale dam vicinity (Rm 4.01	Days[b] to dam
Spring,						
Passed,						
1995	2	5.0(5.0)	0.5(0.5)	37.0(37.0)	34.0(34.0)	8.5
1996	4	1.5(2.3)	0.8(1.5)	10.5(16.2)	8.7(13.5)	7.0
Lost,						
1995	2	5.0(5.6)	4.0(4.5)	37.5(42.3)	31.0(35.0)	15.0
1996	5	1.4(2.4)	0.8(1.4)	13.0(22.6)	5.0(8.7)	5.5
Active,						
1995	6	12.3(13.5)	6.2(6.8)	94.2(103.4)	78.7(86.3)	14.8
1996	2	4.0(6.5)	3.5(5.7)	72.0(117.3)	41.5(67.6)	23.5
Total,						
1995	10	9.4(10.3)	4.6(5.0)	71.4(77.4)	60.2(65.7)	13.6
1996	11	1.9(3.1)	1.4(2.2)	22.8(37.4)	13.0(21.3)	7.5
Fall,						
Active,						
1996	1	4.0(5.3)	3.0(4.0)	61.0(80.7)	5.0(6.6)	6.0
Total,						
1996	1	4.0(5.3)	3.0(4.0)	61.0(80.7)	5.0(6.6)	6.0

[a] Assumed during unknown days fish stayed within the study area. The formula for calculating the correction factor for unknown days was

$$\frac{(NA \times \%T) + D}{n}$$

where

NA = unknown days,

%T = percent of time spent at each given location per fish classification,

D = known days, and

n = number of radio-tagged fish sampled.

[b] Days to the dam was calculated from the day of release until the fish reached Rm 4.0. Only fish that reached Rm 4.0 was included in the calculation. Assumed unsampled days does not effect data.

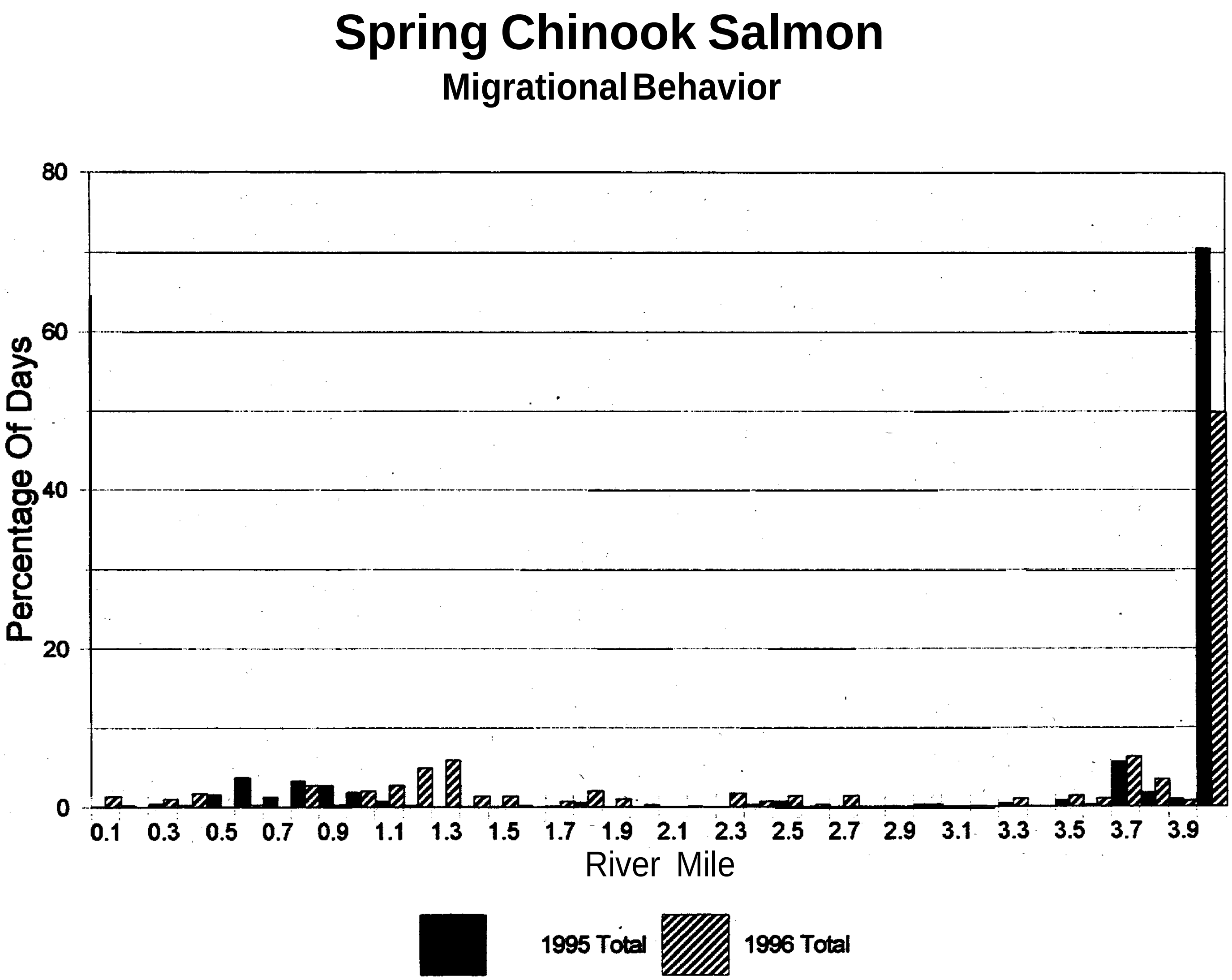


Figure 11. The percentage of days radio-tagged spring chinook salmon used each 0.1 mi section of the Hood River, from the mouth to Powerdale Dam during the radio telemetry study, 1995-96.

1996 Study Results: Twelve spring chinook salmon were radio-tagged between 30 May and 11 June, 1996 and were monitored until 11 October. Six radio-tagged spring chinook salmon were lost during the study. One tagged spring chinook salmon (frequency 40.690) was not located frequently enough to reasonably assess the movement and was therefore not used'in the migrational analysis and classified as lost (Table 9). Of the six remaining radio-tagged spring chinook salmon, four (67%) of the six passed the fish ladder at Powerdale Dam compared to 25% in 1995. On average it took 21 days for the four radio-tagged spring chinook salmon to migrate from the release site until they passed through the ladder. In 1995 study results showed it took passed spring chinook salmon 43.5 days.

Radio-tagged spring chinook salmon spent an average of two days per fish in the Hood River downstream of the tailrace and two days in the powerhouse tailrace vicinity (Table 9). As in 1995, radio-tagged spring chinook salmon spent the majority of their time in the bypass reach (approximately 37 days per fish); 57% of the days in the bypass reach were immediately downstream of the dam (Table 9). In 1996 radio-tagged spring chinook salmon utilized the lower Hood River differently than in 1995 (Figure 11). Areas utilized more in 1996 were Rm 1.0-1.5, Rm 1.7-1.9, and Rm 2.3-2.7 (Figure 11).

Except for one fish, all of the radio-tagged spring chinook salmon that were still in the Hood River had migrated past the powerhouse tailrace before the fixed station was installed (1 July).

Fall Chinook Salmon

1996 Study Results: One fall chinook salmon was radio-tagged on 29 August and was monitored until 27 November, 1996. The fall chinook salmon migrated to Powerdale Dam in six days following release at Rm 0.5. The salmon did not pass the ladder and spent the majority of time (81%) [Table 9] within the bypass reach between Rm 1.5-1.9 and Rm 3.5-4.0 (Figure 12). Fall chinook salmon spawn primarily in the lower Hood River. The fall chinook salmon 'was located in the tailrace for two days in August and four days in September (Appendix Table B-l), a total of 34.1 hours (Table 10).

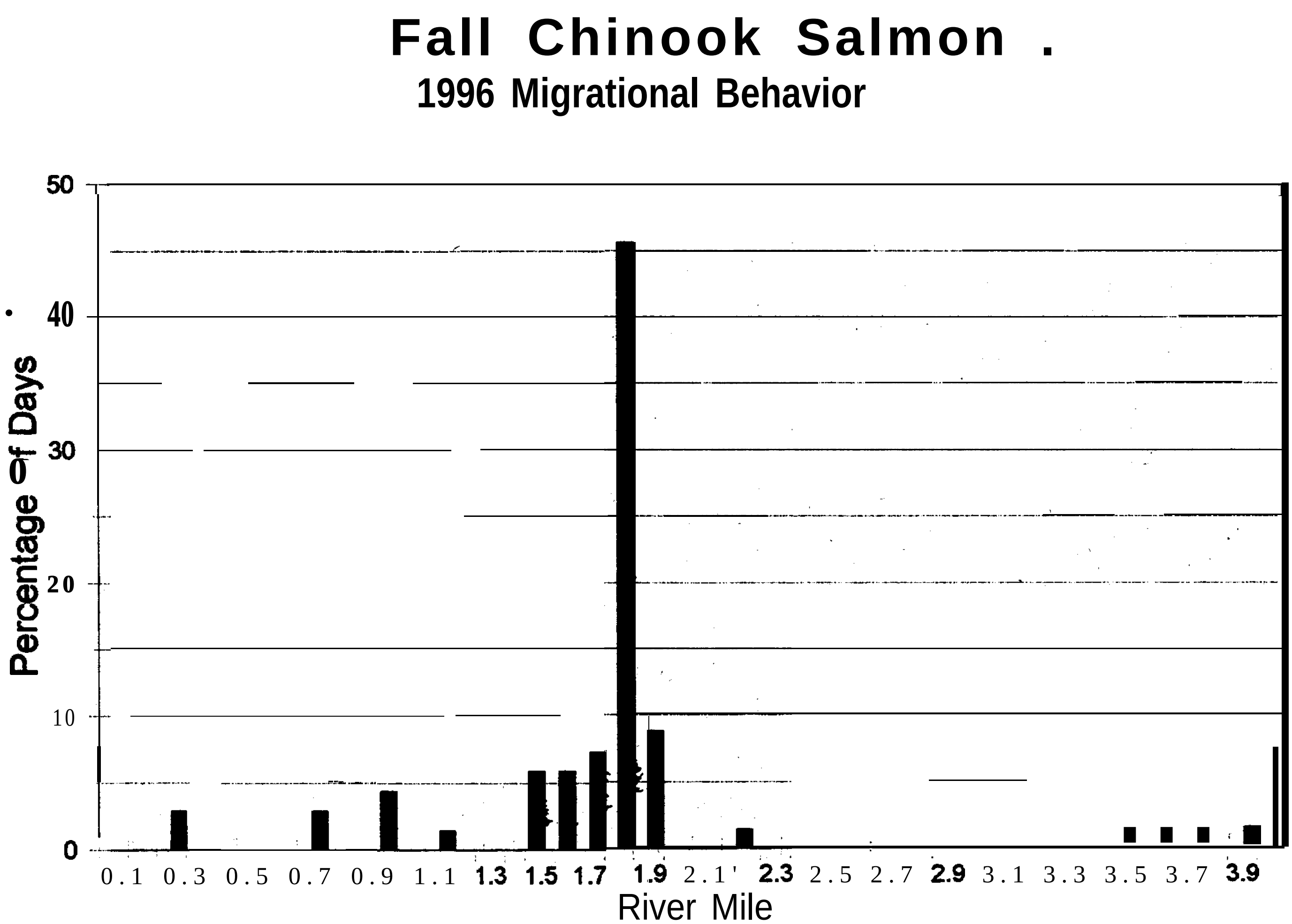


Figure 12. The percentage of days one radio-tagged fall chinook salmon used each 0.1 mi section of the Hood River, from the mouth to Powerdale Dam during the radio telemetry study, **1996.**

Table 10. Species, fish classification, radio tag frequency, month, and total hours per month for one fall chinook salmon was recorded in the powerhouse **tailrace** from July through December, 1996. FCHN = fall chinook salmon. The radio tag frequency followed by * was a recycled tag that occurred more than once in the powerhouse **tailrace** telemetry results.

Species, Fish classifications, Tag frequency,	July	August	September	October	November	December	Total hours in tailrace
FCHN, Active, 41.150*		28.7	5.4				34.1
Monthly Total		**28.7**	5.4				**34.1**

Summer Steel head

1995 Study Results: A total of 26 hatchery summer steelhead were radio-tagged between 1 June and 7 August, 1995 and were monitored until 16 November. An angler harvested one radio-tagged steelhead the day following release and two fish with radio-tags showed little or no movement. Daily migrational data from these three fish were not included in the analysis.

Eighteen radio-tagged summer steelhead (69%) did not pass the fish ladder at Powerdale Dam, including 15 that were lost and three that were still active through 16 November (Table 11). Eight (73%) of the 11 radio-tagged summer steelhead not classified as lost, passed the fish ladder at Powerdale Dam (Table 11). Time required for the summer steelhead to complete the migration from the release site until they passed through the ladder ranged from 12-47 days, with an average of 28.3 days to complete the distance. Of the 23 radio-tagged summer steelhead, 13 reached Powerdale Dam. The tagged summer steelhead averaged 23 days to reach the dam upon release (Table 11).

The 23 radio-tagged summer steelhead spent approximately 15 days per fish in the river downstream of the powerhouse tailrace and eight days per fish in the powerhouse tailrace vicinity (Table 11). Tagged steelhead spent an average of 20 days in the project bypass reach, with over half (11%) of these daily locations immediately downstream of the dam (Table 11). Figure 13 shows the overall usage of the project area in percentages by radio-tagged summer steelhead. Tagged summer steelhead primarily used the river between the mouth and Rm 1.2 and between Rm 3.8 and Rm 4.0. Unlike radio-tagged spring chinook salmon (Figure 12), tagged summer steelhead utilized every section of the lower Hood River (Figure 13).

Table **11.** Migrational patterns for radio-tagged **summer** steelhead in the lower Hood River **(Rm 0.1-4.0), 1995-96.** Table shows mean number of days **summer** steelhead were located downstream of the **tailrace** and within the **tailrace** vicinity, bypass reach, and Powerdale Dam; and mean number of days for fish to reach the dam. (Correction factors for unknown days are in **parentheses)**[a].

Fish classification, study year	n	Downstream of **tailrace** (Rm 0-1-0.8)	**Tailrace** vicinity (Rm 0.9-1.1)	Bypass. reach (Rm 1.2-4.0)	Powerdale dam vicinity (Rm 4.0)	**Days**[b] to dam
Passed,						
1995	8	8.0(8.9)	5.1(5.7)	11.4(12.7)	5.4(6.0)	17.4
1996	19	5.6(6.5)	2.8(3.3)	11.9(13.9)	4.5(5.2)	15.7
Lost,						
1995	12	8.9(9.8)	5.7(6.3)	17.2(19.0)	13.0(14.3)	10.2
1996	11	8.3(9.4)	4.3(4.8)	23.5(26.7)	7.8(8.9)	11.8
Active,						
1995	3	43.3(56.9)	15.0(19.7)	31.3(41.1)	8.0(10.5)	69.0
1996	6	8.5(9.2)	1.0(1.1)	40.5(44.0)	22.5(24.4)	13.0
Total,						
1995	23	13.1(15.3)	6.7(7.9)	17.0(19.9)	9.7(11.3)	22.7
1996	36	6.9(7.8)	3.0(3.4)	20.2(22.9)	8.5(9.6)	14.1

[a] Assumed during unknown days fish stayed within the study area. The formula for calculating the correction factor for unknown days was

$$\frac{(NA \times \%T) + D}{n}$$

where

WA = unknown days,

%T = percent of time spent at each given location per fish classification,

D = known days, and

n = number of radio-tagged fish sampled.

[b] Days to the dam was calculated from the day of release until the fish reached Rm 4.0. Only fish that reached Rm 4.0 was included in the calculation. Assumed unsampled days does not effect data.

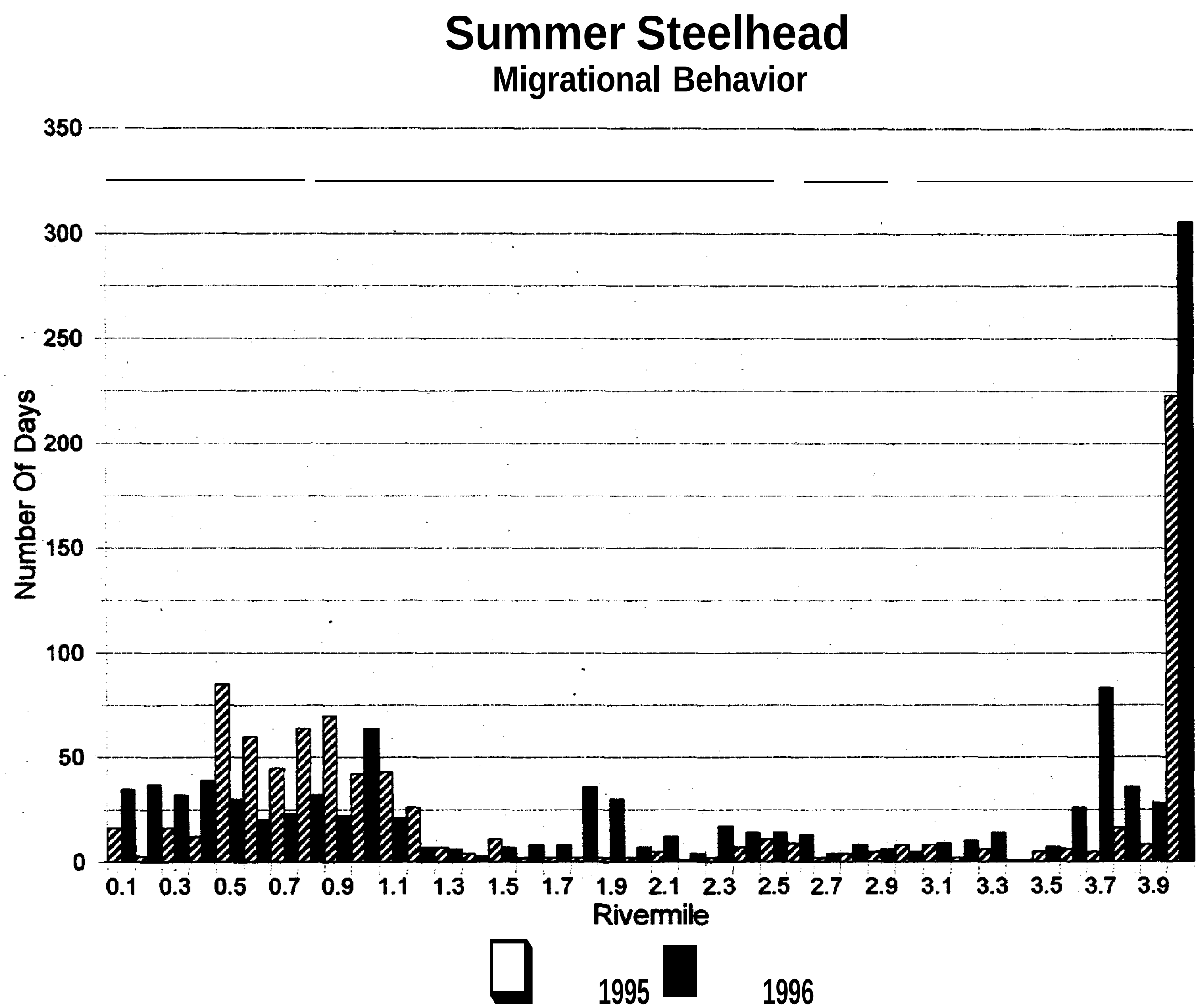


Figure 13. The percentage of days radio-tagged **summer** steelhead used each tenth of a mile during the lower Hood River radio telemetry study, 1995-96.

1996 Study Results: A total of 37 hatchery summer steelhead were radio-tagged between 28 May and 29 October, 1995 and were monitored until 27 November. One tagged steelhead did not have sufficient daily location data to reasonably reconstruct the movement patterns. Data from this fish was not used in the migrational analysis (Table 11).

The percentage of radio-tagged summer steelhead that passed through the fish ladder, 19 of 25 not classified as lost at studies end (76%), was similar to 1995 (73%). Twelve of the radio-tagged summer steelhead were lost during the study (Table 11). It took an average of 25.2 days for the summer steelhead to migrate from the release site through the ladder at Powerdale Dam.

Sumner steelhead radio-tagged in 1996 spent less time downstream of the tailrace and within the tailrace vicinity and more time in the bypass reach than fish tagged in 1995 (Table 11). Radio-tagged summer steelhead spent an average of 23 days in the bypass reach. Sumner steelhead were located within the vicinity of Powerdale Dam for approximately 10 of those 23 days in the bypass reach (Table 11). Radio-tagged summer steelhead held more often between Rm 1.8-1.9 and Rm 3.6-4.0 than in the 1995 study (Figure 13).

Of the 27 summer steelhead radio-tagged after 1 July (fixed station at powerhouse tailrace), 17(63%) were recorded in the project tailrace (Appendix Table B-l). One steelhead radio-tagged prior to 1 July was recorded within the powerhouse tailrace. The time fish spent in the tailrace was variable. The average time an individual fish was in the tailrace ranged from 0.2 to 24 hours per day (Appendix Table B-l). The total number of hours radio-tagged summer steelhead spent in the tailrace was 496.5 hours, and the average time spent in the tailrace was 27.6 hours per fish (Table 12). Most of the time recorded within the powerhouse tailrace occurred between August and October (Table 12).

Table 12. Species, fish classification, radio tag frequency, monthly, and total hours per month for summer steelhead recorded in the Powerhouse tailrace from July through December, 1996. STS = summer steelhead. Radio tag frequencies followed by * are recycled tags that occur more than once in the powerhouse tailrace telemetry results.

Species, Fish classifications, Tag frequency,	July	August	September	ktober	November	December	Total hours in tailrace
STS,							
Passed,							
							4.5
41.100/41.140	4.5	60.3	27.1				87.4
41.110		21.9					21.9
41.170		19.7					19.7
41.150		17.0					17.0
41.202			33.5				33.5
41.100*				1.4			1.4
lost,							
40.650			66.7	63.7	2.7		133.1
41.190		35.8	1.7				37.5
41.230			24.7				24.7
				0.2			2.5
41.252/41.292			11.1	21.8			32.9
Active,				3.6			
41.220				6.4			3.6
							7.7
41.310/41.270			1.3			22.6	22.6
41.330				44.3			44.3
41.110*					2.2		2.2
Monthly Total	4.5	154.7'	168.4	141.4	4.9	22.6	496.5

Discussion

The 1995 radio telemetry data collected on radio-tagged spring chinook salmon and summer steelhead showed a considerable delay in migration at Powerdale Dam (CTWS and ODFW, 1996). Several minor modifications were performed to improve the ladder entrance for these fish, however, they did not improve passage. The fish attraction flow to the ladder was modified in early 1996 and now exits the first pool in the ladder. The modified attraction flow may have resulted in spring chinook salmon and summer steelhead finding the ladder quicker. Spring chinook salmon spent an average of 66 days at the dam in 1995. Twenty-five percent (2 of the 8 remaining at studies end) passed over the dam. In 1996, spring chinook salmon spent an average of 21 days at the dam. Sixty-seven percent (4 of the,6 remaining at studies end) passed through the ladder. Summer steelhead in 1995 spent an average of 11 days at the dam and 73% of the remaining steelhead at studies end passed the dam, compared to an average of 10 days at the dam and 76% passing through the fish ladder in 1996.

Results from the powerhouse tailrace telemetry station and the mobile tracking indicate that some fish entered the tailrace (Rm 0.9-1.0). Without additional studies in the powerhouse tailrace, project fisheries biologist could not determine if radio-tagged spring chinook salmon or summer steelhead delayed or falsely attracted to the powerhouse discharge channel. The mobile radio tracking results differed from 1995 to 1996. In 1995, radio-tagged spring chinook salmon averaged five days in the vicinity of the powerhouse tailrace, compared to two days in 1996; tagged summer steelhead spent eight and three days per fish in 1995 and 1996, respectively. Fish recorded by the powerhouse tailrace telemetry station, ranged from 1 to 17 different days in the tailrace (Appendix Table B-l). Except for one fall chinook salmon, all the fish recorded were summer steelhead; spring chinook salmon had already migrated past. the tailrace by the time the fixed station was set up on 1 July. The average time spent in the tailrace was 27.6 hours per day for summer steelhead.

The primary spawning areas for summer steelhead are in the upper subbasin above Powerdale Dam, while fall chinook salmon spawn primarily in the mainstem Hood River. Sumner steelhead enter the Hood River as early as March of a given calendar year and have finished by late April to early May of the second calendar year (Olsen et al., 1996). The median migration date for wild summer steelhead occurred during July. These fish will be in the subbasin for several months until spawning (February-May). Based on the radio telemetry study and adult migration patterns, it does not appear that the powerhouse tailrace is preventing summer steelhead from reaching the spawning areas, Additional studies of the tailrace would be needed for fall and spring chinook salmon to determine if there was delay.

Hood River Water Temperature Study

Introduction

Water temperatures for the Hood River subbasin have been collected the past six years to satisfy baseline data requirements. The baseline data has been collected by CTWS staff since 1990 for the mainstem (Rm 3.9), West Fork (Rm 16), and East Fork (Rm 15) -and since 1994 for the Middle Fork (Rm 19) [Figure 14]. In addition, water temperatures have been collected from Rogers Spring and a zone of mixed Middle Fork and Rogers Spring waters since May of 1995 (Rm 19) [Figure 14]. This study is being conducted to evaluate the use of mixed Middle Fork and Rogers Spring waters in holding broodstock and acclimation at the Parkdale facility.

Methods

Ryan Tempmentor thermographs were used to collect the baseline water temperature data. Temperatures were recorded every two hours and data was downloaded into a computer every few months. Downloaded data for each site was reviewed for anomalies and summarized into monthly and annual monthly minimum, maximum and mean temperatures (Tables 13-16). Extreme high and low temperature anomalies, presumably caused by dewatering or freezing, were excluded from the data summaries. Hobo Temperature Loggers were used to collect water temperatures for the Parkdale study. Temperature data was recorded every half hour and downloaded every few months. Downloaded data was sumnarized into daily, monthly, and annual monthly minimum, maximum, and mean temperatures (Tables 17-18).

Results and Discussion

The annual monthly mean temperatures for the baseline-data ranged from 2.9°C-10.2°C for the Middle Fork, 2.9°C-14.3°C for the East Fork, 3.4°C-11.8°C for the West Fork, and 3.9°C-14.5°C for the mainstem Hood River. Winter steelhead broodstock may be held and spawned at the Parkdale facility from January through May. During this time the annual monthly mean temperatures for Rogers Spring ranged from 3.9°C-4.8°C and 2.7°C-7.0°C for the Middle Fork and Rogers Spring mixed waters. Spring chinook broodstock may be held and spawned at Parkdale from mid-May through September. During this time the annual monthly mean temperatures for Rogers Spring ranged from 4.8°C-5.2°C and 7.0°C-9.7°C for the mixed waters.

Temperature preferences for rearing and incubating anadromous salinonids fall between 7.8°C and 15°C with danger zones at <0.6°C or >20°C (Bottom et al. 1985). Although average monthly minimum and maximum water temperatures for the baseline data occasionally exceed the Bottom et al. criteria, the annual monthly means fall within the maximum temperature preferences and outside the danger zones for all months. Acclimation of salmonids at Parkdale would occur in April and May. Mean temperatures for these two months fall below the reported temperature preferences and outside the danger zones.

Meehan (1991) recommended temperatures of 3.9°C-9.4°C for spawning of steelhead and 5.6°C-13.9°C for spawning of chinook. The Parkdale study results for Rogers Spring fall within the steelhead criteria for January through May, but below the chinook criteria for the months of May through September. Temperatures for the mixed waters fall below the steelhead criteria for January and February, but within the chinook criteria for the months of May through September.

Figure 14

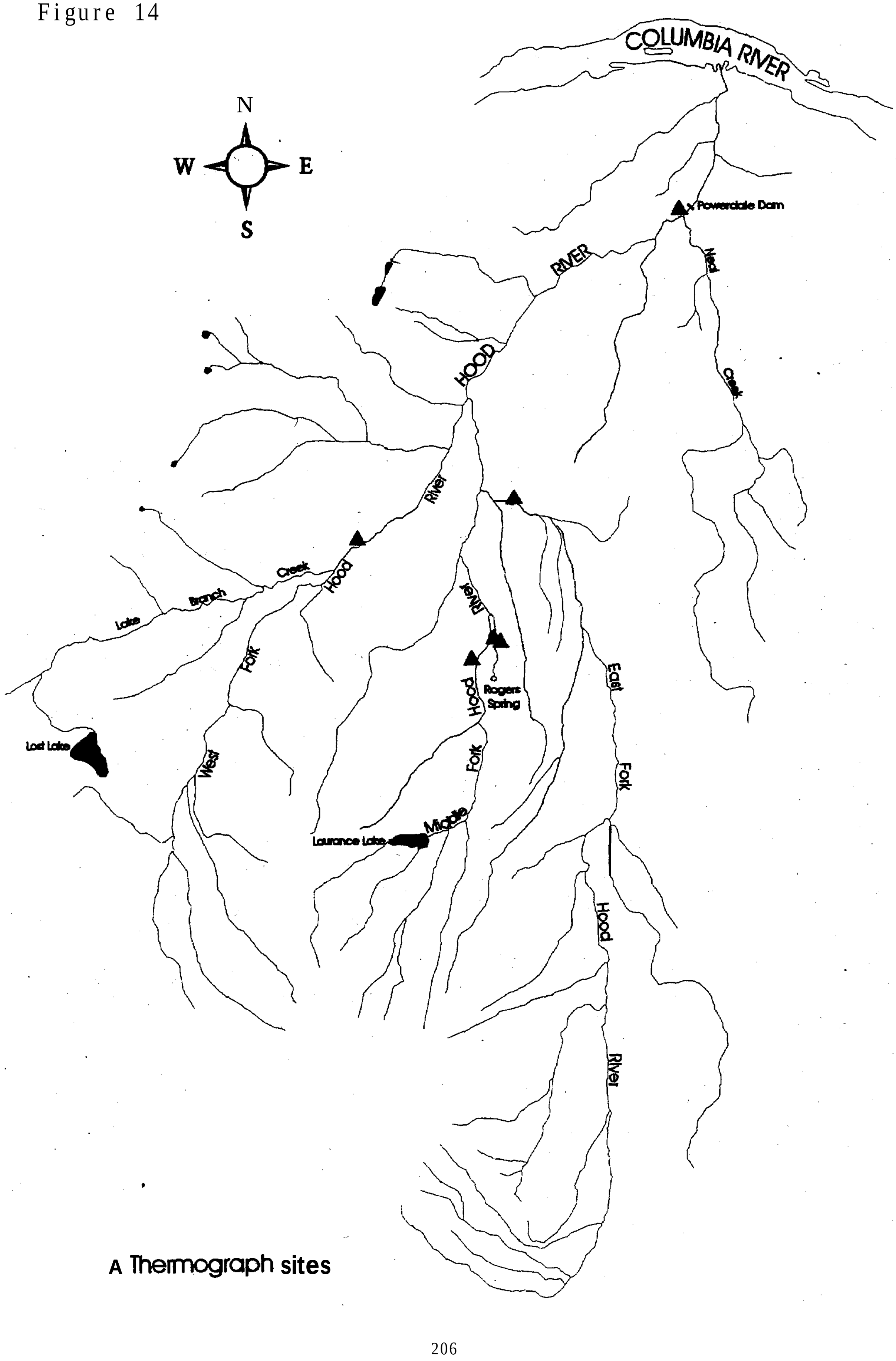

COLUMBIA RIVER
N
W
E
S
Powerdale Dam
Neal
Creek
RIVER
HOOD
River
Hood
Creek
Branch
Lake
Fork
West
Lost Lake
River
Hood
Rogers
Spring
Fork
Middle
Laurance Lake
East
Fork
Hood
River
Thermograph sites

Table 13. Minimum, maximum, and mean water temperatures ("C) for the Middle Fork Hood River (Rm 19), 1994-96.

Year, Statistic	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1994,												
Min.	1.9[a]	-0.1	2.4	4.6	6.0	5.6	5.4	7.3	8.0	4.9	1.8	1.0
Max.	4.3[a]	5.7	a.9	11.3	13.8	14.7	14.6	14.1	14.0	12.3	5.7	52
Mean	3.0[a]	3.3	4.8	7.1	8.8	9.7	102	10.4	10.4	7.5	3.9	3.3
1995,												
Min.	0.4	0.7	2.0	4.6[a]				7.8[a]	7.8	3.7	2.9	-1.5
Max.	4.6	6.1	7.8	8.8[a]				12.9[a]	13.8	12.0	7.6	6.4
Mean	2.9	'3.9	4.6	6.3[a]				10.3[a]	10.3	7.8	5.9	2.6
1996;												
Min.	-1.7[b]	-0.2	1.4	4.1	4.8	6.1	6.0	6.9	7.1	4.9	0.2	-0.1
Max.	5.0[b]	5.6	6.4	9.0	11.2	12.7	13.4	13.3	12.8	11.3	7.1	4.6
Mean	3.0[b]	2.6	4.4	6.1	7.6	9.3	10.1	10.0	9.8	7.7	4.9	2.8
Annual,												
Min.	0.6	0.1	13	4.4	5.4	5.9	5.7	7.3	7.6	4.5	1.6	-0.2
Mu.	4.6	5.8	7.7	9.7	12.5	13.7	14.0	13.4	135	11.8	6.8	5.4
Mean	3.0	3.3	4.6	6.5	8.2	9.5	10.2	10.2	10.2	7.7	4.9	2.9

a Incomplete month of data.

b Data anomalies extracted.

Table 14. Minimum, maximum, and mean water temperatures ("C) for the West Fork Hood River (Rm 16), 1990-96.

Year, static	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1990,												
Min.							8.5[a]	9.1	8.1	5.0	4.1	-0.4
Max.							15.4[a]	15.6	13.6	11.5	8.6	5.7
Mean							11.8[a]	11.9	10.8	7.5	6.2	2.9
1991,												
Min.	-0.3	3.4	1.9	32	4.8	5.7	8.7	9.0	6.9	1.7	2.9[b]	1.8
Max.	5.3	6.4	8.0	9.8	11.1	13.6	15.0	15.5	13.1	11.3	8.5[b]	6.6
Mean	2.9	4.8	4.5	5.8	7.3	9.0	11.4	12.0	10.2	7.2	5.6[b]	4.5
1992,												
Min.	1.8	3.5	4.1	4.1	5.7	8.2	10.0	8.4	7.1	4.8	3.3	1.7
Max.	6.0	6.7	9.7	10.7	14.3	17.1	16.8	16.6	13.6	11.3	8.9	4.8
Mean	4.1	5.1	6.3	7.2	9.8	11.9	12.8	12.5	10.2	8.1	6.1	3.4
1993,												
Mill.	0.7	0.0	0.4	4.4	4.9	72	82		5.8	5.1	0.0	0.7
Max.	4.2	5.1	3.4	7.7	11.6	13.4	13.4		132	11.0	7.6	5.3
Mean	2.1	2.7	4.5	5.8	8.0	9.4	102		9.7	8.0	3.3	3.1
1994,												
Mill.	2.3	0.0	2.8	4.1	5.0	6.6	8.1	9.7	8.4	5.2	2.6	1.6
Max.	5.6	5.0	7.6	10.0	13.4	14.1	16.7	15.6	12.7	11.6	6.7	5.3
Mean	4.1	2.8	4.5	6.3	8.8	. 9.7	122	122	10.8	7.7	4.6	3.8
1995,												
Min.	0.8	0.6	2.1	3.6	5.3	6.7	8.8	8.3	7.4	3.5	2.7	0.5
Max	4.7	6.5	7.4	9.5	13.1	13.9	15.3	15.2	13.3	10.3	8.5	7.5
Mean	32	4.3	4.6	5.9	8.3	9.6	11.6	11.1	10.6	7.9	6.7	4.2
1996,												
Min.	0.6	03	2.3	4.4	s.2	6.7	8.1	8.5	62	4.9	1.1[a]	
Max.	S.8	3.1	6.1	8.5	10.0	12.8	15.0	14.3	122	10.5	7.3[a]	
Mean	3.9	5.1	4.6	6.0	7.2	9.6	11.6	11.2	9.4	7.6	5.5[a]	
Annual,												
Min.	1.0	2.8	2.3	4.0	5.2	6.9	8.6	8.8	7.1	43	2.8	LO
Max.	5.3	5.5	7.7	9.4	123	14.2	15.4	15.5	13.1	11.1	7.0	5.9
Mean	3.4	4.1	4.8	6.2	8.2	9.9	11.7	11.8	10.2	7.7	5.4	3.7

[a] Incomplete month of data.

[b] Data anomalies extracted.

Table 15. Minimum, maximum, and mean water temperatures ("C) for the East Fork Hood River **(Rm 15)** in degrees **Celcius.** 1990-96.

Year, static	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1990,												
Min.							9.3[a]	9.5	7 . 4	3.7	2.78	
Max							20.4[a]	21.1	18.0	13.6	9.3[a]	
Mean							14.7[a]	14.8	12.7	7.7	5.6"	
1991,												
Min.												
Max.												
Mean												
1992,												
Min.			3.5'	3.2	4.7	8.2	10.6[b]	8.5	6.4	3.0	1.3	-0.1
Max.			11.8'	13.4	18.7	22.0	22.8[b]	22.8	18.7	12.4	8.4	4.8
Mean			7.5[a]	7.9	11.0	14.4	16.1[b]	15.5	11.7	8.5	4.8	2.0
1993,												
Min.	-0.2	-0.2	-0.1	3.8	5.0	6.7	8.1[b]	7.8[b]	5.3	4.1	-0.1	0.2
Max	4.6	6.0	8.3	10.7	13.4	17.1	17.3[b]	17.7[b]	17.4	12.7	8.3 .	5,6
Mean	1.3	2.4	4.7	6.7	8.8	10.5	12.0[b]	12.3[b]	11.2	8.4	2.7	2.5
1994,												
Min.	1.1	-0.4	1.9	3.8	4.4	6.5	8.3	10.3	8.5	3.8	0.9	0.4
Max.	6.1	5.9	10.3	12.8	15.3	18.3	21.6	20.6	17.1	13.0	6.4	5.9
Mean	3.;	2.8	5.2	7.5	9.3	11.6	15.0	15.1	12.7	7.5	3.9	3.5
1995,												
Mill.	-0.2	6.1	1.5	4.2[a]				9.3[a]	7.1	1.6	1.0	-0.1
Max.	6.2	7.7	9.0	10.3[a]				15.6[a]	16.7	11.5	8.5	6.8
Mean	3.1	4.6	5.0	7.0[a]				12.5[a]	11.9	7.6	6.2	3.7
1996,												
Min.	-0.4	-0.4	1.1	3.9	4.2	6.6	8.4	9.2	5.9	3.4	-0.6	-0.4
Max.	6.0	6.2	8.1	11.6	12.8	15.4	19.0	18.4	15.6	126	7.5	5.0
Mean	3.6	2.4	5.1	6.9	8.0	10.8	13.7	13.5	10.7	7.8	4.5	3.0
Annual,												
Mii	0 3	-0.3	1.6	3.8	4.6	7.0	8.9	9.1	6.8	3.3	a 9	0.0
M U	5.7	6.5	9.5	11.8	15.1	18.2	20.2	19.4	17.3	12.6	8.1	5.6
Mean	2.9	3.1	5.5	7.2	9.3	11.8	14.3	14.0	11.8	7.9	4.6	2.9

[a] Incomplete month of data.

[b] Data anomalies extracted.

Table 16. Hinimum, maximum, and mean water temperatures ("C) for the **mainstem** Hood River at Powerdale Dam (Rm 4.0), 1990-96.

Year, Statistic	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1990,												
Min.							11.0[a]	112	10.0	5.8	4.3	-0.1
Max.							18.2[a]	18.5	16.3	13.2	9.6	6.4
Mean							14.9"	14.8	13.2	8.6	6.6	3.0
1991,												
Mill.	0.0	3.7	2.6	4.1	6.0	7.8	11.3	11.6	8.6	2.4	3.3	2.8
Max.	5.9	8.1	10.0	11.8	13.4	16.0	17.6	18.8	15.9	13.4	9.4	7.5
Mean	2.9	5.5	5.6	7.5	9.5	11.7	14.5	15.0	12.6	8.5	6.1	5.0
1992,												
Min.	2.6	3.7	4.7	5.2	6.6	12.6"					0.9[a]	0.1
Max.	7.1	8.5	11.3	13.1	17.1	16.8[a]					7.4[a]	5.5
Mean	5.0	6.1	7.6	8.8	12.0	14.5[a]					5.1[a]	3.0
1993,												
Mm.	-0.1	4.1	0.1	4.9	6.4	8.6	10.7	10.1	7.5	5.6	-2.0	1.6
Max.	5.1	6.1	8.1	9.8	13.4	16.3	16.3	18.0	16.1	13.0	8.6	6.0
Mean	1.9	3.2	4.7	7.2	9.9	11.6	13.1	14.0	12.0	9.4	3.6	3.6
1994,												
Min.	2.1	-0.1	3.2	5.2	6.6	8.5	10.3	12.0	10.0	3.0	1.2[b]	1.7
Max.	6.4	6.4	10.0	12.3	15.9	17.3	19.6	19.0	15.9	13.6	8.0[b]	6.6
Mean	4.6	3.6	5.9	8.3	10.9	12.5	15.4	15.3	13.0	8.8	5.4[b]	4.7
1995,												
Min.	0.7	0.9	2.7	5.0	7.4	8.2	11.0	10.2	8.9[b]	3.3	2.1	12
Max.	6.8	8.1	9.2	11.3	15.4	16.7	17.9	18.3	16.4[b]	11.8	9.4	8.5
Mean	4.1	5.6	6.2	8.0	10.5	12.1	14.4	13.1	13.0[b]	8.8	7.2	4.9
1996,												
Min.	0.1	0.1[b]	2.3	4.9	5.7	8.5	10.2	11.2	7.6	5.1	0.5[a]	
Max.	7.0	8.9[b]	9.2	11.4	12.9	15.3	18.0	17.3	14.7	12.0	8.2[a]	
Mean	4.6	4.9[b]	6.2	7.7	9.0	11.9	14.5	13.9	11.4	5.8	5.8[a]	
Annual,												
Min.	0.9	1.4	2.6	4.9	6.5	9.0	10.8	11.0	8.8	4.2	1%	1.2
Max.	4.4	7.7	9.6	11.6	14.7	16.4	17.9	18.3	15.9	12.8	86	6.8
Mean	3.9	4.8	6.0	7.9	10.3	12.4	14.5	14.4	12.5	8.3	5.7	4.0

[a] Incomplete month of data.
[b] Data anomalies extracted.

Table 17. Minimum, maximum, and mean water temperatures ("C) for Rogers Spring and Middle Fork Hood River mixed waters (Rm 19), 1995-96.

Year, Statistic	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
1995												
Mill.					5.3[a]	5.6	6.9[a]	7.4	5.3[a]	3.0[a]	2.8	2.0[a]
Max.					10.0”	10.6	10.6’	12.0	12.3[a]	11.2[a]	6.1	5.7”
Mean					7.8[a]	7.7	7.7[a]	9.5	9.0[a]	6.4[a]	4.9	3.8[a]
1996												
Mill.	1.4	1.6	2.1	3.8	4.2[a]	6.9	6.0[a]	4.1[a]	5.2	3.3	2.0	1.2[a]
Max.	3.8	3.6	5.0	6.4	7.8[a]	10.9	14.2[a]	14.5[a]	11.5	10.2	5.3	3.5’
Mean	3.0	2.7	3.9	5.1	6.2[a]	8.3	9.6[a]	9.9”	7.9	5.7	3.9	2.3[a]
Annual												
Min.	1.4	1.6	2.7	3.8	4.8	6.3	6.4	5.7	5.3	3.2	2.4	1.6
Max.	3.8	3.6	5.0	6.4	8.9	10.8	12.4	13.3	11.9	10.7	5.7	4.6
Mean	3.0	2.7	3.9	5.1	7.0	8.0	8.6	9.7	8.5	6.0	4.4	3.0

[a] Incomplete month of data.

Table 18. Minimum, maximum, and mean water temperatures (°C) for Rogers Spring (Rm 19), 1995-96.

Year, Statistic	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
<u>1995</u>												
Mm.					4.7[a]	4.9[a]	5.2	5.0	5.0[a]	4.7	4.6	3.6[a]
Max					5.3[a]	5.5[a]	5.7	5.5	5.5[a]	5.3	5.5	4.6[a]
Mean					5.0[a]	5.2[a]	5.3	5.3	5.2[a]	5.1	4.8	4.3[a]
<u>1996</u>												
Mill.	3.9	2.3	4.1	4.4	4.4[a]	4.7	4.9	4.9[a]	4.8[a]			
Max.	4.7	42	4.7	5.0	5.0"	5.5	53	5.3[a]	5.3[a]			
Mean	4.4	3.9	4.4	4.7	4.78	4.9	5.0	5.1[a]	5.0[a]			
<u>Annual</u>												
Min.	3.9	3.0	4.1	4.4	4.6	4.8	5.0	5.0	5.0	4.7	4.6	3.6
Max.	4.7	4.2	4.7	5.0	5.2	5.5	5.5	5.4	5.4	53	5.5	4.6
Mean	4.4	3.9	4.4	4.7	4.a	5.0	5.2	5.2	5.1	5.1	4.8	43

[a] Incomplete month of data.

HABITAT

Introduction

The CTWS staff were involved in habitat related functions throughout 1996. Data was gathered to assist in refining the smolt carrying capacity in the Hood River subbasin. Project staff spent time evaluating potential habitat improvement projects in the Hood River subbasin. Habitat improvement projects will be assessed and incorporated in the HRPP habitat restoration plan. This plan will be written in the FY 1997 and 1998. Most landowners have been eager to work with CTWS staff towards habitat improvement. One riparian fencing project was completed on Neal Creek in 1996 as part of the Tribal Early Action Projects funded by BPA.

Carrying Capacity

Current smolt carrying capacity for the Hood River subbasin was determined by the subbasin planners using a computer simulation model developed by the NPPC called the Tributary Parameters Model (TPM). Input was provided to the subbasin planners on habitat ratings and stream characteristics by a technical committee. The technical committee was comprised of personnel from the ODFW, U.S. Fish and Wildlife Service, USFS. Soil Conservation Service, National Marine Fisheries Service, and CTWS. Smolt production capacity was estimated at 24,000 spring chinook, 32,000 summer steelhead, and 31,000 winter steelhead (ODFW & CTWS, 1090). This estimate was based on a subjective evaluation of the quality of habitat on selected reaches throughout the watershed and on assumptions held of spatial distribution for each population.

The approach used to estimate carrying capacity for the subbasin planning process had several limitations. At the time estimates were generated, no quantitative and little qualitative information was available to accurately rate the quality of habitat within the Hood River subbasin for any given reach of stream. Also, many assumptions were made about the spatial distribution for each population. Further, there was little or no information available to validate estimates of the various model parameters and a lack of any quantitative information specific to Hood River stocks (Department of Natural Resources (CTWS), 1993).

Current numbers of summer and winter steelhead and spring chinook salmon smolts migrating from the Hood River subbasin (Report A) are far less than numbers estimated by the subbasin planners as the smolt carrying capacity. These low outmigrant numbers support the need for supplementation. The HRPP will continue to refine carrying capacity numbers to determine if the Hood River Master Plan's run size and spawner escapement goals are achievable. Knowledge of carrying capacity will be useful in developing strategies to optimize subbasin escapement;

Habitat surveys and summaries on the Hood River watershed were completed by 1995 for most anadromous salmonid bearing tributaries. Surveys were conducted on USFS managed land by the Hood River Ranger District and on private and some public lands by ODFW. Data collected by USFS, using the Hankin and Reeves survey type, was converted into a format used by ODFW. The data base of sunnarited habitat will help in analyzing the watershed habitat quality for carrying capacity and assist managers in potential habitat restoration plans. Locations of areas surveyed, by agency and year, are presented in Report A.

Spatial distribution information and population estimates (including surface area) were collected in 1996 to assist in refining carrying capacity numbers. Spatial distribution data for anadromous salmonid and resident trout will be useful in the analysis of carrying capacity. A variety of methods have been used in collecting spatial distribution information. Radio telemetry studies have been used to estimate the distribution of adult spring chinook salmon, coho, and winter and summer steelhead. Also, some adult information exists from spawning ground surveys conducted by the USFS. The distribution of juvenile salmonids was estimated using electroshocking, snorkeling, and migrant screw trapping techniques. This information and data will help define habitat use type for each salmonid species.

Population estimates and surface area measurements were collected by CTWS and ODFW from 1994 to 1996 (Report A). This information provides a better understanding of smolt production capacity (i.e., smolts/m^2) for various reaches of stream in the Hood River subbasin.

There is no commonly accepted model for estimating carrying capacity. The HRPP will expand on the TPM's concept by refining several parameters in the model based on stock. specific information. This technique will be used to estimate carrying capacity, however it requires reviewing and updating annually to increase its accuracy. Many variables are involved and considerable attention must be given to each one. Two alternative carrying capacity models have been discussed and can be used to evaluate the existing model. One method is regressing brood year specific estimates of smolt production with brood year specific estimates of spawner escapement. Project staff will be looking for some optimum level of smolt production. This model will require monitoring smolt production and spawner escapement for several years to develop the regression curve and to account for between-year-variation in smolt production. Estimates of selected environmental factors will be included in the regression to determine which, if any, of the environmental factors, that we propose monitoring, currently limit carrying capacity in the subbasin. The other alternative is measuring smolt production using migrant traps. Accumulative numbers of smolts outmigrating on a year to year basis could be graphed. Carrying capacity would be estimated at the point when outmigration stabilizes for a period of years and a trend could be recognized.

Neal Creek Riparian Fencing

A half-mile of the riparian area of Neal Creek (Rm 3.0) was fenced to exclude livestock and 100 cubic yards of rip rap rock was placed. This project will enhance water quality, stabilize the streambanks, reduce sediment, and provide additional juvenile fish rearing habitat. This project should encourage other landowners to participate in improving fish habitat within the Hood River subbasin.

Photo points were established in the project area for evaluating changes that occur seasonally over time. Fish population surveys will be conducted to document the response to long term riparian improvements.

ENGINEERING

Powerdale Dam Adult Fish Facility

Construction of the Powerdale Dam adult fish facility began on 25 September, 1995 and was operational by December, 1996. The facility was constructed on one-half acre of project land, east of Powerdale Dam, in an area previously impacted by flooding in 1964 and 1977 and dam construction. Construction included;

1) an access road to the fish facility off Highway 35,
2) adult fish trap and sorting pond adjacent to the existing ladder,
3) an elevator to allow sorting and distribution of fish to;
   return pipe to river,
   adult holding and recovery ponds,
   and a fish truck,
4) holding ponds and associated service buildings,
5) water conveyance system for ponds and elevator, and
6) electrical supply access to new facilities.

Parkdale Adult Holding Pond And Egg Collection Facility

The proposed facility on Rogers Spring Creek near Parkdale will be used to hold and spawn winter and summer steelhead and spring chinook salmon adults and to acclimate winter steelhead and spring chinook salmon juveniles prior to release. This site was chosen because of the excellent water quality. BPA has been negotiating to purchase approximately 4 hectares (10 acres), of which about half will be developed. As of January, 1997, the purchasing process was near completion. BPA will fund facility construction, operation, and maintenance. BPA will handle all engineering design, either with BPA engineers or with an engineering consultant for BPA, with technical assistance from ODFW.

The facilities will consist of two adult holding ponds with inside dimensions of about 12.5 by 2.5 by 1.2 meters (41ft. x 8ft. x 4ft.), two concrete juvenile acclimation ponds with inside dimensions of about 24 by 2.5 by 1.2 meters (80ft. x 8ft. x 4ft.), associated piping from the powerhouse tailrace to the ponds and from the ponds back to the creek, and a small weir and trap in Rogers Spring Creek just below the outfall of the power plant.

Also proposed is a building about 33 by 6 meters (108ft. x 20ft.) which will contain an office, spawning and storage area, and a bunkhouse for other project personnel; and a 2-bedroom house for a full-time, on-site employee. A septic field for the residences and accommodations for effluent from the holding ponds will be needed. A new well and associated piping will provide water for the residences. In addition, approximately 600 meters (1,975ft.) of roads and access approaches about 4 meters (12ft.) wide are needed. Roads, access, and parking spaces will be blacktopped.

When the adult holding and juvenile acclimation ponds are in full operation, they will require about 0.15 m^3/s (5.3 cfs) of water. The acclimation ponds will be used April through mid-May each year. They alone will require 0.09 m^3/s (3.3 cfs) of water each day of this period. The adult holding ponds will be used year-round and will require a constant flow of about 2 cfs.

Construction of these facilities will begin in late 1997. The facilities will allow holding and spawning spring chinook salmon and winter and summer steelhead adults captured in the Powerdale fish trap. The facilities could acclimate and release up to 80,000 spring chinook and 40,000 winter steelhead smolts when needed. Some of the juveniles currently being acclimated at Toll Bridge Park (E.F. Hood River) and Dry Run Bridge (W.F. Hood River) will be acclimated here to better distribute fish throughout the subbasin.

OAK SPRINGS HATCHERY EVALUATION

Introduction

The percent coded-wire tag retention and clipping results on Hood River stock hatchery winter steelhead have been evaluated by HRPP personnel since the 1994 brood year. These fish are reared at OSH where coded-wire tagging and clipping takes place. All tagging is contracted through the ODFW tagging and clipping program. Hatchery winter steelhead production at OSH was graded into two size groups small and large prior to tagging in late October. Each size group was reared in a separate raceway at OSH.

Methods

Coded-wire tag retention is evaluated using a coded-wire tag detector. A subsample of fish from ponds L3 and L4 were sampled and the tag was either present or absent. For clipping evaluations, a random sample of marked fish were sampled from ponds L3 and L4 to evaluate the quality of mark combinations used on hatchery winter steelhead. Hatchery juveniles were examined and classified as 1) not clipped (>75% remains), 2) poor clips (25-75%) or 3) clipped (less than 25% remains) based on a subjective evaluation of each mark group present in the ponds.

Results

Tag retention and clipping results were good for the 1993 brood year (Table 19). Tag retention for the 1994 brood year were considered poor (Table 20). On 28 November 1994, Pond L3 had a tag loss of 4.2% and pond L4 had a tag loss of 11.1%. The 11.1 percent tag loss for pond L4 seemed high by project staff and was reevaluated on 5 April 1995, and showed an even higher tag loss of 13.4%. The 1994 brood of hatchery winter steelhead was marked with an adipose (Ad) and left ventral (LV) clip. Clipping results were very poor for the 1994 brood (Table 21). On 28 November 1994, of the 378 hatchery winter steelhead smolts sampled in pond L3, ten percent had poor Ad clips and 3% had poor LV clips. Furthermore, 2% of the adiposes were not clipped. The 1994 brood year results for pond L4 were similar to pond L3. On 5 April 1995, nine percent of the winter steelhead smolts sampled had poor Ad clips and 2% had poor LV clips. In addition, 1% of the adiposes were not clipped.

Tag retention results for the 1995 hatchery winter steelhead brood year were better than the 1994 brood year (Table 20). Coded-wire tag retention was 100% for pond L3 and 97.1% for pond L4. Fin clipping quality for the 1995 brood deteriorated evan further over the 1994 brood. The 1995 brood was clipped with an Ad-LV and right maxillary (RM). Although Ad and RM clips were excellent, poor LV clips (25% in pond L-3 and 19% in pond L-4) were a problem (Table 21).

Table 19. Percent tag retention and clipping results for the 1993 brood year winter steelhead. (Ad = adipose, LV = left ventral)

Broodstock, hatchery, brood year,	Tag code	Fin clip	Date	Percent tag retention	Percent fin clip
Hood River,					
Oak Springs,					
1993	07-05-36	Ad-LV	14-Oct-93	99.7	99.4
1993	07-05-37	Ad-LV	14-Oct-93	100.0	99.7
1993	07-05-38	Ad-LV	19-Oct-93	89.2	99.7
1993	07-05-39	Ad-LV	19-Oct-93	99.4	99.2

Table 20. Percent coded-wire tag retention, tag code, and clipping information for winter steelhead. (adipose = Ad, left ventral = LV, right maxillary = RM)

Broodstock, hatchery, brood year	Pond	Tag code	Fin clip	Date sampled	Percent tag retention
Hood River,					
Oak Springs,					
1994	L-3	07-08-63	Ad-LV	28-Nov-94	95.8
		07-09-16			
1994	L-4	07-09-17	Ad-LV	28-Nov-94	88.9
		07-09-18			
1994	L-4	07-09-17	Ad-LV	05-Apr-95	86.6
		07-19-18			
1995	L-3	07-11-31	Ad-LV-RM	12-Jan-96	100.0
1995	L-4	07-11-32	Ad-LV-RM	12-Jan-96	97.1

Table 21. Clipping results for winter steelhead at Oak Springs Hatchery. (Percent of total number sampled is in parentheses. Ad = adipose, LV = left ventral, RM = right maxillary.)

Broodstock, hatchery, brood year	Pond	Fin clip	Date sampled	Number sampled	No Ad	Poor Ad	No LV	Poor LV	No RM	Poor RM
Hood River, Oak Springs,										
1994	L-3	Ad-LV	28-Nov-94	378	7(2)	38(10)	0(0)	10(3)		
1994	L-4	Ad-LV	28-Nov-94	350	4(1)	15(4)	0(0)	6(2)		
1994	L-4	Ad-LV	05-Apr-95	322	3(1)	28(9)	0(0)	8(2)		
1995	L-3	Ad-LV-RM	12-Jan-96	104	0(0)	0(0)	2(2)	26(25)	0(0)	0(0)
1995	L-4	Ad-LV-RM	12-Jan-96	102	0(0)	0(0)	0(0)	19(19)	0(0)	0(0)

Discussion

Continued monitoring of tag retention and clipping at OSH is necessary. Poor tag retention and clipping results for the 1994 brood winter steelhead resulted in a more careful evaluation of tagging and clipping procedures at OSH. Although coded-wire tag retention problems were eliminated in the 1995 brood, poor quality fin clipping continued to be a problem. HRPP personnel will continue to work with OSH to improve fin mark quality.

GENETICS

Inland steelhead were collected from the Warm Springs River, located in the Deschutes subbasin, in 1996. Samples collected in 1996, along with samples collected in 1993, 1994, and 1995 were being used to characterize trout populations by allozyme electrophoresis and morphology in the Hood River basin and surrounding areas to determine if and where hybridization was occurring (Table 22). Funding.for the survey and analysis was provided by ODFW, USFS, and BPA. The analysis was contracted to Dr. Fred Allendorf at the University of Montana through the genetics program at ODFW.

Table 22. Whole juvenile fish collected in the Hood River and surrounding subbasins for genetic inventory and analysis. 1995 & 1996.

Collection site	Date sampled	River mile	Species	Number	Map location
Oak Springs Hatchery	06/27/95	----	Summer Steelhead-Stock 40	31	----
Oak Springs Hatchery	06/27/95	----	Rainbow-Stock 53	30	- -
Oak Springs Hatchery	10/05/95	----	Winter Steelhead-Stock SO	35	----
Roaring River Hatchery	06/27/95	....	Rainbow-Stock 13	30	---
Big Creek Hatchery	08/01/95	....	Winter Steelhead-Stock 13	32	- -
Fifteenmile Creek	06/15/95	33.5	Rainbow-Steelhead	31	R13E/T1S SECT33
Eightmile Creek	06/15/95	30.0	Rainbow	30	RI 1 E/T2S SECT 9
W.F. Hood River	06/15/95	4.5	Rainbow-Steelhead	7	R9E/T1N SECT 22
S.F. Mill Creek	07/13/95	10.0	Cutthroat	26	R11E/T1S SECT 16
S.F. Mill Creek	07/13/95	2.0	Rainbow-Steelhead-Cutthroat	30	R12E/T1N SECT 33
Fivemile Creek	07/13/95	19.0	Cutthroat	30	R11E/T1S SECT 24
Warm Springs River	05/23/96	1.0	Summer Steelhead	29	R14E/T8S SECT 20

A preliminary report in 1995 by Ron Gregg and Fred Allendorf (University of Montana) found (1) the North Fork Greenpoint resident trout population appeared to be pure rainbow trout, (2) the Pinnacle Creek resident trout population is largely cutthroat with some evidence of rainbow trout hybridization, and (3) Dog River, Emile Creek, Robinhood Creek, Pocket, and Bucket Creek all show morphology and electrophoretic evidence consistent with pure cutthroat trout (Lambert et al. 1996).

Another progress report was completed on 2/6/97 by Paul Spruell (University of Montana) primarily discussing genetic analysis methods (Appendix C). The University of Montana has continued to identify DNA markers which would be informative. Once the DNA markers are complete, fish collected for genetic samples will be analyzed and a final report will be completed.

COMPLIANCE WITH THE NATIONAL ENVIRONMENTAL POLICY ACT

When the NPPC approved the Hood River Production and the Pelton Ladder Master Plans, they directed BPA to move ahead with implementation contingent upon a finding of no significant impact in an environmental analysis. A categorical exclusion was completed in 1992 for the Hood River Production Program. The categorical exclusion included both the Hood River and the Pelton Ladder. Items excluded on the Hood River included:

1. design and construction of fish monitoring facilities at Powerdale Dam,
2. modifications of bypass system at Farmers Irrigation District diversion for smolt monitoring facilities,
3. baseline population estimates,
4. production estimates,
5. habitat condition surveys,
6. carrying capacity estimates, and
7. genetic studies.

The item excluded on the Pelton Ladder included:

1. physical modification of Pelton Ladder for additional rearing ponds.

BPA determined that the actual release of hatchery fish for the Hood River Supplementation Program needed additional environmental analysis.

In the spring of 1995, BPA filed a Notice of Intent (NOI) to proceed with an Environmental Impact Statement (EIS) for the supplementation portion of the program. Public scoping meetings were held in April, 1995 in Portland, Hood River, and Warm Springs, Oregon. No significant or highly controversial issues were raised during the scoping process. Work on the Draft EIS continued through February, 1996. The Draft EIS was distributed for public review in March and finalized in July, 1996. A record of decision was completed 10 October, 1996 by Randy Hardy (Administrator of BPA). The decision was to proceed with Alternative 1, because it best meets the need and purposes stated in the Final EIS and has the best potential for re-establishing or rebuilding and sustaining populations of anadromous salmonids in the Hood River subbasin via a combination of supplementation, habitat improvements, and a monitoring and evaluation program. The EIS was a cooperative effort between BPA, CTWS, and ODFW (DOE and BPA 1996).

PELTON LADDER

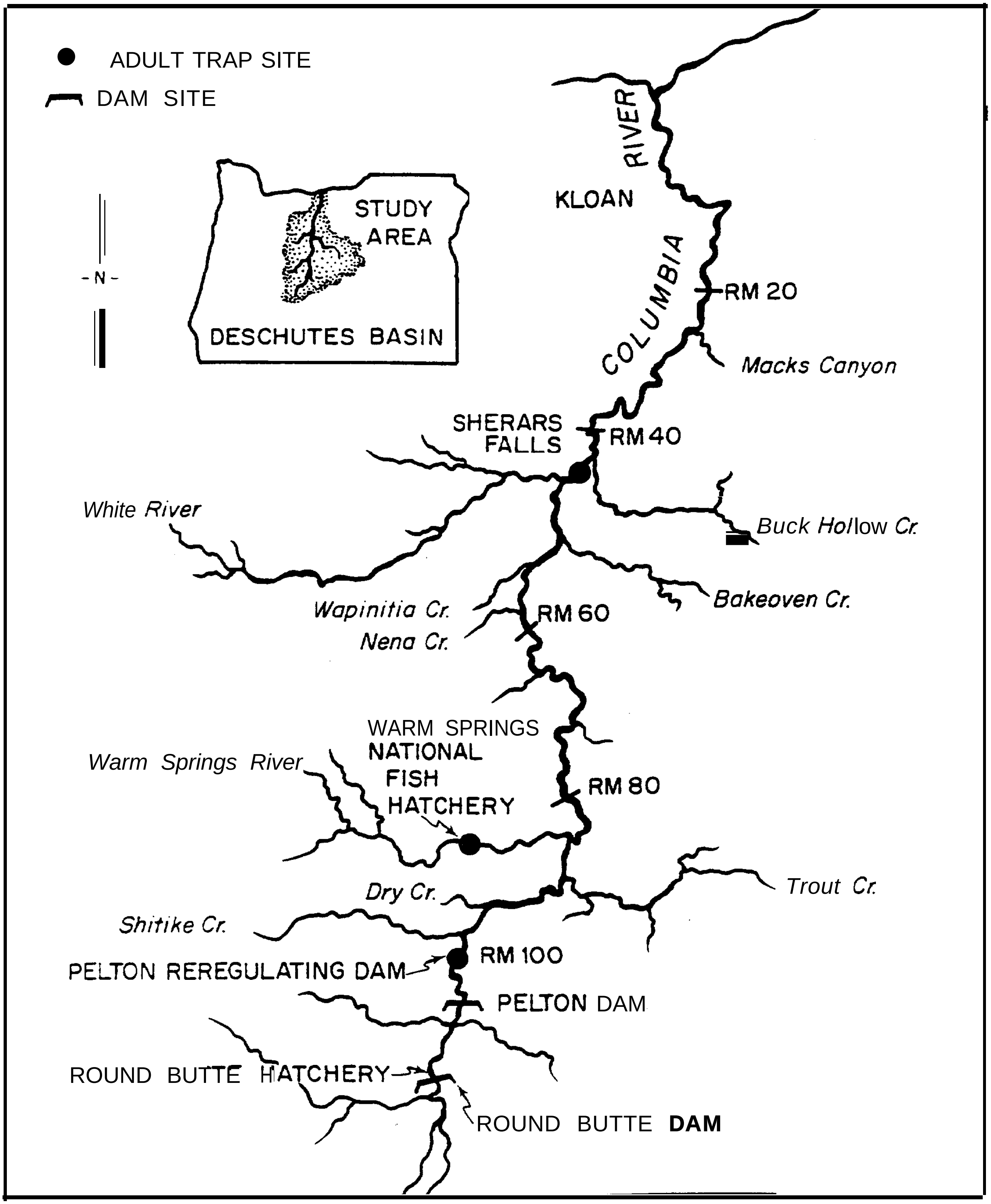
INTRODUCTION

The NPPC's Columbia River Basin Fish and Wildlife Program set a goal to double the runs of Columbia River salmon and steelhead. This increase is designed to offset losses resulting from the development and operation of the Columbia River hydropower system.

In its amended (1987) Fish and Wildlife Program, the NPPC included a goal to increase fish production at Pelton Ladder as a low-capital means of contributing to additional adult returns in the Columbia Basin and Deschutes River subbasin. The NPPC further specified that the ODFW and CTWS prepare a Master Plan prior to any design and construction. The Master Plan was completed in July, 1991 (Smith, M. 1991). Additional background information on the Deschutes River subbasin can be found in Lindsay et al., 1987 and 1989.

Pelton Ladder is an adult fishway extending from below Pelton Regulating Dam to the Pelton Dam (Rm 100), which impounds Lake Simtustus (Figure 15). The ladder is 10 feet wide, 6 feet deep, and 2.8 miles long. It was originally designed and constructed to allow passage of adult chinook salmon and summer steelhead around the reregulating dam to Lake Simtustus. However, the ladder was abandoned for adult passage after the facilities at Round Butte Dam (located above Pelton Dam) failed to effectively pass juvenile salmonids downstream.

In the early 1980's, Pelton Ladder was modified and used as a rearing site for some of the juvenile spring chinook produced at RBH. This hatchery, funded by Portland General Electric (PGE), was developed to mitigate for losses of spring chinook and summer steelhead caused by the Pelton-Round Butte hydroelectric projects. The aim of the program is to achieve the mitigation level of 1,200 adults returning to Pelton trap each year. Prior to the 1994 brood year, RBH produced 270,000 spring chinook smolts as part of this mitigation effort.



ii gure 15. Lower 100 miles of the Deschutes River.

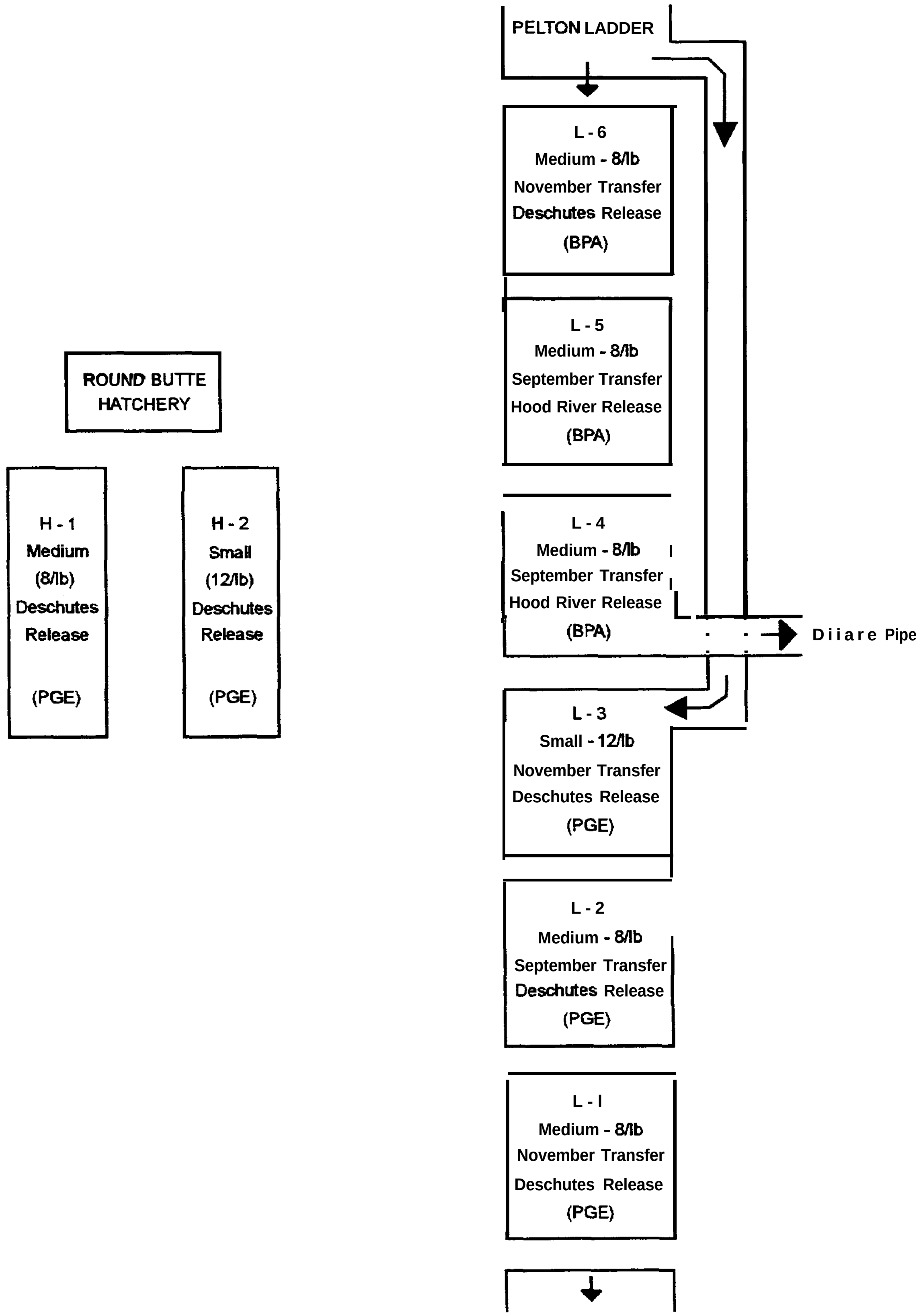


Figure 16. Ponding plan for RBH/Pelton Ladder to accommodate production of study fish.

In 1995, as part of the HRPP, the ladder was modified to create three new cells for rearing Deschutes stock hatchery spring chinook salmon (Figure 16). The three new cells were modified to replicate the existing rearing strategy in each section. These modifications allow the capability to rear 187,000 additional spring chinook smolts. Fish reared in the new cells, L-4 and L-5, have been released into the Hood River since 1996. New cell L-6 (uppermost cell), is used as an experimental study group for release into the Deschutes River. Upon completion of the Pelton Ladder studies, juvenile spring chinook salmon reared in the new cell (L-6) will be used for increasing production in the Hood River.

METHODS

The objective of experimental releases of spring chinook salmon from Pelton Ladder and RBH was to determine if modifying Pelton Ladder to rear more fish would reduce effectiveness of the existing production program. Furthermore, the study will evaluate how size at time of release effects post-release survival and provide basic information about rearing conditions in the ladder. Comparisons of the modified Pelton Ladder cells will be made against post-release survival rates of fish reared in the lower three cells of Pelton Ladder and hatchery ponds at RBH. Figure 16 shows the ponding plan for RBH/Pelton Ladder to accommodate production of study fish.

Natural food availability in Pelton Ladder and variable water temperatures are rearing conditions that may contribute to higher return rates of spring chinook salmon. To evaluate the need for a macroinvertebrate study, approximately 15 whole fish were collected monthly from December through March in each ladder cell and hatchery pond. Smolts were collected at RBH by simply netting them from the pond. Pelton Ladder smolts were collected by seining the lower end of each cell and randomly collecting 15 fish from a few hundred collected. Whole fish were frozen with liquid nitrogen immediately, transported on dry ice, and kept in a freezer until analyzed. Whole fish were then thawed and stomach contents were evaluated for natural consumption. Stomach samples were sorted as either having consumed aquatic insects or not and content was identified where possible.

A Hobo temperature logger was used to collect water temperatures for Pelton Ladder throughout the rearing of spring chinook salmon smolts. Temperature data was recorded every hour and was downloaded at the end of rearing. Downloaded data for each site is reviewed for anomalies and is summarized into daily mean temperatures.

Rearing Procedures

Spring chinook salmon broodstock was collected randomly at Pelton Trap throughout the run between early May and mid June. 500 adults were collected and held at the hatchery. Spring chinook salmon adults not needed for broodstock were given to the CTWS after snouts were removed from coded-wire tagged fish.

Spawning of spring chinook salmon at RBH occurred in late August and in early September. One male was used to fertilize the eggs of one female. Approximately 700,000 eggs were taken to produce 454,000 smolts needed for release. The eggs were moved to Heath incubators and place on chilled water (5.5°C). Chilled water slowed the incubation period down and allowed smolts to be released as spring yearlings (fish reared from egg-take until spring of the second year). In the incubator eggs were water hardened for one hour and disinfected in a 10ppm iodopher solution for 10 minutes.

After the eggs had eyed, they were shocked and sorted to remove dead and blank eggs. The chiller was turned off in late December. Fry were reared in ambient 10.5°C water in 6 ft diameter circular tanks until they reached a size of at least 300 fish/lb. Fry targeted as mediums (8 fish/lb) were then transferred in March to a single Burrows pond. Fry targeted as smalls (12 fish/lb) were transferred in April. Larges were then split again in early May from one to two ponds. All ponds of spring chinook fingerlings were split again in July and August after being marked. Fish reared in Pelton Ladder were transferred there either in September, October, or November and allowed to migrate volitionally the following April. Information on spring chinook fry at time of transfer is found in Appendix Tables D-1 and D-2.

All chinook salmon targeted for release into the Deschutes River were marked with an adipose fin clip and a coded-wire tag, while those smolts destined to the Hood River were marked with an adipose and left ventral fin clip and a coded-wire tag. Tag retention was determined just before release by crowding the fish in a pond and taking eight to ten independent samples of about 100 fish each. Each fish in the sample was examined for a fin clip. The presence of a coded-wire tag was assessed with a field detector. Spring chinook salmon juveniles were weighed (g) and measured (mn) and condition factors (weight [g] * $100/\text{length}^3$ [mm]) were calculated prior to release in the spring.

Coded-wire tags from returning adults were recovered from snouts of fish collected at the Pelton Trap, Warm Springs National Fish Hatchery, and tribal and non-tribal fisheries at Sherars Falls. Return rate was calculated as the percentage of juveniles released with coded-wire tags that returned as adults.

RESULTS AND DISCUSSION

Release of spring chinook salmon smolts for this study was in 1996. Study results, based on post-release survival rate, between the newly modified and old cells of Pelton Ladder and ponds at RBH will be analyzed upon adults returns. The first adult returns for the study are expected in 1998. Mean length, weight, and condition factors were estimated for Deschutes spring chinook salmon smolts reared at RBH and Pelton Ladder prior to release (Table 23). Mean condition factors for the 1994 brood ranged from 1.13 to 1.19. Weight was not measured and condition factors were not calculated on Pelton Ladder cells 4 and 5 prior to release into the Hood River.

Table 23. Estimates of mean fork length (FL; mm), weight (g), and condition factor (CF) for Deschutes stock hatchery spring chinook salmon smolts sampled at Pelton Ladder (C = cell) and Round Butte Hatchery (H = pond) prior to release into the Deschutes and Hood River subbasins[a], 1996.

Statistic, pond or cell, brood year	N	Mean	Range	95% C.I.
FL (mm),[b]				
H-l,				
1994	152	178.1	135 - 260	± 10.6
H-2,				
1994	209	158.9	135 - 195	± 9.4
C-l,				
1994	226	174.7	120 - 245	± 8.2
c-2,				
1994	210	170.3	130 - 260	± 8.7
c-3,				
1994	204	165.1	130 - 245	± 8.7
C-4,				
1994	226	158.6	125 - 265	± 8.4
c-5,				
1994	229	160.9	125 - 240	± 8.8
C-6,				
1994	200	148.9	125 - 210	± 8.8

Table 23. Continued.

Statistic, pond or cell, brood year	N	Mean	Range	95% C.I.
Weight (g),				
H-l,				
1994	152	69.5	26.2 - 188.1	± 0.9
H-2,				
1994	209	46.4	25.8 - 97.0	± 1.5
C-l,				
1994	226	66.0	22.6 - 178.1	± 0.1
c-2,				
1994	210	59.8	23.4 - 199.4	± 0.08
c-3,				
1994	204	54.5	24.6 - 164.1	± 0.3
c-4,				
1994	200	39.8	22.8 - 117.8	± 1.3
CF,[c]				
H-l,				
1994	152	1.17	0.90 - 1.63	± 0.08
H-2,				
1994	209	1.13	0.85 - 1.60	± 0.06
C-l,				
1994	226	1.15	0.78 - 1.53	± 0.07
c-2,				
1994	210	1.13	0.84 - 1.40	± 0.07
c-3,				
1994	204	1.15	0.90 - 1.42	± 0.07
C-6,				
1994	200	1.19	0.95 - 1.51	± 0.07

[a] Juveniles were sampled within one week of release.
[b] Lengths were rounded to the nearest 5 mm.
[c] Condition factor was estimated as (weight [g] * 100/length^3 [mm]).

Water temperatures for the 1995-96 study in Pelton Ladder were variable, ranging from a minimum of 4.1°C to a maximum of 14.5°C from October 6, 1995 to April 26, 1996. The mean water temperature was 8.5°C. Water temperature at RBH was a constant 10.5°C.

Stomach Analysis Of Spring Chinook Salmon Smolts

Stomach analysis showed 51% of the smolts in Pelton Ladder rearing cells consumed natural food, compared to 17% at the RBH ponds (Tables 24 and 25). Furthermore, RBH fish natural food consumption was barely measurable, compared to the ladder reared fish. RBH smolts had less than five pieces of aquatic insects (smaller than 1 mm in size) in their stomach. Stomach analysis of spring chinook smolts from Pelton Ladder showed they were actively feeding on natural food. Thirty one (18%) of the total 173 had greater than 10 pieces, including full bodied insects, in the stomachs. Identified invertebrates included adult Diptera, Trichoptera, Coleoptera, and their larvae.

Lindsay et al. (1987) mentioned natural food in Pelton Ladder as a rearing condition that may contribute to higher return rates of juvenile spring chinook salmon reared in Pelton Ladder than in Round Butte Hatchery. Based on stomach analysis, we believe natural food consumption may be contributing to smolt quality at Pelton Ladder and a study to quantify or negate the benefit should be completed.

Table 24. Diet composition, by percentage of spring chinook salmon smolts consuming natural food in Round Butte Hatchery ponds, 1995-96.

Location, pond	Date sampled	Number sampled	No natural food consumed	Natural food consumed
Round Butte,				
H-l	12/18/95	13	10	3
H-l	02/07/96	15	11	4
H-l	03/06/96	14	8	6
H-2	12/18/95	10	10	0
H-2	02/07/96	14	14	0
H-2	03/06/96	15	14	1
Total	**All dates**	**81**	**67(83%)**	**14(17%)**

Table 25. Diet composition, by percentage of spring chinook salmon smolts consuming natural food in Pelton Ladder rearing cells, 199596.

Location, ladder cell	Date sampled	Number sampled	No natural food consumed	Natural food consumed
Pelton				
ladder,	12/22/95	14	5	9
C-l	02/05/96	13	7	6
C-l	03/04/96	14	5	9
C-l				
c-3	12/22/95	15	9	6
c-3	02/05/96	13	7	6
c-3	03/04/96	15	7	8
c-4	12122195	16	9	7
C-4	02/07/96	14	5	9
C-4	03/04/96	14	0	14
C-6	12/18/95	15	8	7
C-6	02/07/96	15	12	3
C-6	03/04/96	15	10	5
Total	**All dates**	173	**84(** 49%)	**89(51%)**

RECOMMENDATIONS

The purchase and installation of emergency pumps at Pelton Ladder need to be considered in future budgets. Emergency pumps would be necessary if there was a loss of water supply to the fish rearing cells. Loss of water could result in fish mortality or an early release of spring chinook salmon fingerlings. An early release could result in an indirect mortality. When considering emergency pumps, project staff should consider needs for future additional cells.

Stomach analysis of spring chinook smolts indicate a need for a macroinvertebrate study to quantify or negate the natural food benefit of rearing smolts at Pelton Ladder versus RBH. Furthermore, the study should evaluate the differences between the old and new cells at Pelton Ladder and what the effects may be if additional cells were added. Based on observation at the ladder, careful attention should be given to the earthen section of the ladder and how much natural food benefit is produced within that section.

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APPENDIX A

Acclimation Data

Appendix Table A-1. Temperature, dissolved oxygen, and mortality in the portable raceway during winter steelhead acclimation, East Fork Hood River, 1996.

Date	Time	Temperature °C	Dissolved oxygen (ppm)	Mortalities
Apr. 1	1700	7.7	9.73	3 (2 transp)
2	0630	4.3	7.93	4
	1530	6.5	9.49	
	1815	5.8	8.11	
3	0830	4.1	10.69	7
	1415	7.7	9.86	
4	0745	3.8	10.03	5
	1200	6.5	7.25	
	1600	8.3	7.45	
	1900	7.4	9.13	
5	0700	4.3	8.95	2
6	1315	9.4	6.40	1
	1830	9.7	7.50	
7	0900	5.9	a.70	1
	1400	9.4	9.69	
	1900	10.7	8.68	
a	1930	6.2	7.24	
9	1630	8.2	7.71	
10	0730	5.3	8.24	
11	0845	5.0	10.02	
	1830	6.1	9.30	
12	0815	5.3	9.75	
	1840	5.4	8.95	
13	0700	3.5	9.55	
	1300	6.2	8.85	
	1830	8.0	8.35	
14	0800	4.2	9.67	0
	1330	7.6	9.08	
	1900	a.2	8.17	
15	0700	5.1	9.43	0
	1530	8.5	8.50	
	1930	8.1	8.66	

Appendix Table A-l. Continued.

Date	Time	Temperature °C	Dissolved oxygen (ppm)	Mortalities
Apr. 16	0800	5.8	9.54	0
	1315	7.6	9.23	
	1900	7.1	9.15	
17	1100	5.2	9.16	0
	1800	6.2	8.67	
18	0700	4.1	9.71	0
	1430	5.9	9.14	
	1845	6.3	a.83	
19	0730	3.8	9.60	0
	1300	4.8	9.48	
	1945	5.4	9.32	
20	0715	3.6	9.80	0
21				0
22				2(2 transp)
23	0815	5.9	7.91	5(2 transp)
	1310	7.3	7.38	
	1750	7.0	8.24	
24	0705	4.8	8.25	3(1 transp)
	1315	5.3	7.60	
	1715	6.9	6.59	
25	0715	5.1	8.50	8
	1415	6.9	6.81	
26	0700	4.4	8.30	7
	1330	6.7	6.95	
	1720	8.0	6.30	
27	0750	4.2	8.60	9
	1425	7.6	7.0	
	1930	7.0	7.15	
28	0800	3.8	8.25	13
	1430	8.0	6.85	
	1900	8.1	6.98	
29	0735	5.9	7.68	11
	1500	9.2	7.32	
	1900	8.6	7.10	

Appendix Table A-l. Continued.

Date	Time	Temperature °C	Dissolved oxygen (ppm)	Mortalities
Apr. 30	0800	5.1	8.45	12
	1430	8.5	8.15	
	1930	8.3	8.03	
May 1	0730	6.1	8.16	7
	1215	7.4	6.68	
	1400	8.2	6.47	
2	0710	5.4	8.20	0
	1330	6.7	8.15	
	1930	5.7	8.25	
3	0800	5.4	8.20	
	1300	6.5	a.35	
	1930	6.4	8.30	
4	0800	4.1	8.20	
	1330	7.4	7.65	
	1900	7.6	7.69	
5	0730	4.7	9.18	2
	1230	6.4	8.38	
	1900	7.8	7.56	
6	0800	4.2	9.03	0
	1330	8.2	8.32	
	1900	8.5	8.41	
7	0730	4.7	9.35	0
	1200	5.6	9.12	
	1900	6.3	9.09	
8				13(6 transp)

Appendix Table A-Z. Temperature, dissolved oxygen, and mortality in the portable raceways during spring chinook salmon acclimation, West Fork Hood River, 1996.

Date	Time		Temperature °C		Dissolved oxygen (ppm)		Mortalities[a]	
	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2
Apr. 8							38	0(38)
9	1400		6.6				9	42(43)
10		1500		6.5		6.34	6	16(22)
11	1000	1040	5.9	5.9	9.53	9.47	24	6(21)
12	0650	0715	5.0	4.9	9.56	9.64	4	7
	1830	1830	5.0	4.9	9.67	9.43		
13	0745	0745	4.9	4.9	10.42	9.80	2	6
	1200	1200	5.4	5.5	9.97	9.97		
	1800	1800	6.1	5.9	9.61	9.51		
14	0700	0725	4.7	4.8	9.57	9.94	1	16
	1200	1216	5.5	5.6	9.84	10.02		
	1800	1838	5.5	5.3	6.72	6.51		
15	0655	0712	4.6	4.6	9.96	9.45	2	1
	1200	1400	4.5	4.5	9.83	9.79		
	1800	1820	5.6	5.6	10.01	9.98		
16	0609	0631	4.6	4.6	9.65	9.89	0	0
	1157	1210	5.2	5.2	10.25	8.45		
	1800	1800	5.0	5.0	9.50	6.31		
17	0700	0700	4.5	4.4	9.38	9.36	0	0
	1248	1258	5.4	5.4	9.79	9.50		
	1800	1815	4.9	4.9	9.53	9.55		
18	0830	0832	4.5	4.5	10.10	10.21	0	0
	1200	1200	4.6	4.6	9.51	10.10		
	1810	1812	4.7	4.7	9.82	9.83		
19	0730	0732	4.3	4.3	9.98	9.73	0	0
	1200	1202	4.6	4.6	9.80	9.68		
	1650	1650	5.2	5.2	8.44	8.75		
20	0810	0812	4.4	4.5	9.43	9.10	0	0
	1200	1223	5.2	5.5	9.80	9.78		
	1800	1813	5.5	5.7	9.93	9.91		
21	0700	0700	4.4	4.4	9.50	9.53	1	0
	1200	1208	5.4	5.5	9.84	9.85		
	1800	1818	4.9	4.9	9.45	9.45		

Appendix Table A-2. Continued.

Date	Time		Temperature °C		Dissolved oxygen (ppm)		Mortalities[a]	
	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2
Apr. 22	0700	0711	4.5	4.5	9.37	9.40	108	0(19)
	1428	1435	5.1	5.1	8.55	8.36		
	1800	1813	5.8	5.8	9.54	9.54		
23	0632	0645	4.8	4.8	9.68	9.66	55	91(21)
	1155	1207	5.7	5.7	9.60	9.60		
	1800	1822	5.6	5.6	9.77	9.79		
24	0700	0709	4.4	4.4	9.38	9.38	31	64
	1200	1215	4.9	4.9	9.98	9.50		
	1800	1808	5.4	5.4	9.73	9.84		
25	0545	0602	4.4	4.4	9.98	9.96	20	36
	1200	1203	5.9	5.9	8.48	8.56		
	1800	1815	6.0	6.0	8.39	8.39		
26	0700	0715	5.0	5.0	8.39	8.27	13	31
	1300	1230	5.7	5.7	8.42	8.57		
	1815	1800	5.9	5.9	7.58	7.42		
27	1715	0700	4.8	4.8	7.85	8.03	5	17
	1213	1200	5.5	5.5	9.84	9.85		
	1858	1812	5.8	5.8	9.75	9.75		
28	0700	0710	4.1	4.1	9.95	9.95	9	24
	1201	1225	4.3	4.3	9.98	9.99		
	1800	1813	4.5	4.5	10.02	to.01		
29	0700	0715	4.4	4.4	9.87	9.84		7
	1200	1221	5.9	5.9	8.99	8.93		
	1800	1819	4.7	4.7	9.50	9.58		
30	0630	0645	4.3	4.3	9.45	9.45		1
	1200	1210	4.5	4.5	9.93	9.93		
	1800	1800	5.6	5.6	8.83	8.70		
May 1							0	0
2							0	8
3	1800	1830	4.4	4.4	9.85	9.85	0	0
4	0700	0711	4.1	4.1	7.53	7.53	0	4
	1230	1242	4.2	4.2	8.82	8.82		
	1900	1918	4.5	4.5	9.28	9.27		

Appendix Table A-Z. Continued.

Date	Time		Temperature °C		Dissolved oxygen (ppm)		Mortal i ties'	
	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2	Pond 1	Pond 2
May 5	0700	0710	4.1	4.1	7.45	7.45	0	0
	1200	1207	4.3	4.3	6.99	6.95		
	1800	1813	4.2	4.2	9.35	9.35		
6	0700	0714	4.0	4.0	8.77	8.77	0	0
	1307	1314	4.4	4.4	8.89	8.94		
	1900	1919	4.3	4.3	8.54	8.54		

[a] In parentheses is mortalities from fish truck liberations.

Appendix Table A-3. Biweekly counts of migrant wild rb-st (STW) and hatchery winter steelhead (HSTW) marked (M) and recaptured (R) at the mainstem migrant trap. (percent recapture = %).

Location,	April 1-15			April 16-30			May 1-15			May 16-31			June 1-15			June 16-30			Julv 1-15		
Species	M	R	%	M	R	%	M	R	%	M	R	%	M	R	%	M	R	%	M	R	%
Mainstem,																					
STW	14	1	7.1	5	3	60[a]	178	12	6.7	296	20	6.8	76	5	6.6	1	1	100	2	0	0
HSTW	50	3	6.0	95	a	8.4	409	19	4.6	343	19	5.5	246	3	1.2	10	0	0	2	0	0

[a] The formula for calculating STW trapping efficiency for 16-30 April was using a ratio comparison of hatchery and wild trapping efficiency numbers between 1-15 April and l-15 May and comparing them to the time period 16-30 April. The formula was

$$\frac{13.8}{10.6} = \frac{X}{8.4}$$

$$X = 10.9$$

APPENDIX B

Radio Telemetry Data

Appendix Table B-l. The radio frequency, date, and time of fish recorded in the Powerdale powerhouse tailrace in 1996. STS = summer steelhead, and FCHN = fall chinook. Radio tag frequencies followed by * are recycled tags that occur more than once in powerhouse tailrace telemetry results. Results originated from unpublished data on 2/6/97 from the Fish Division, PacifiCorp, Portland, Oregon.

Frequency	Date	Time	Total Hours	Comments
41.140	Jul.01	1530-2000	4.5	STS, released on Jun.24; was in lower river (Rm 0.5 to Rm 1.0) from Jun.28 to Jul.01; passed ladder on Jul.05.
41.100	Aug.04	1000-2400	14.0	STS, released on Ju1.29; was in lower river (Rm 0.5 to Rm 1.2) from Jul.29 to Sep.13; passed ladder on Sep.17.
	Aug.05	0000-1200	12.0	
		1610-2400	7.83	
	Aug.06	0000-2400	24.0	
	Aug.07	0000-0230	2.5	
	Sep. 12	1410-2400	9.83	
	Sep.13	0000-1715	17.25	
41.170	Aug.05	2315-2340	0.42	STS, released on Aug.05; was in vicinity of tailrace (Rm 0.9 to Rm 1.1) from Aug.06 to Aug.10; passed ladder on Aug.15.
	Aug.08	1030-1920	8.83	
	Aug.09	0920-1130	1.83	
		1600	0.17	
		1830-2240	4.17	
	Aug.10	1330-1745	4.25	
41.110	Aug.09	0915-0940	0.42	STS, released on Aug.04; signal heard in lower river (Rm 0.6 to 1.0) on Aug.06, Aug.07, and Aug.11; was in ladder vicinity (Rm 3.7 to Rm 4.0) from Aug.15 to Sep.13; passed ladder on Sep.13.
		1530	0.17	
		1645	0.17	
		1700-1800	1.0	
		1915-2400	4.75	
	Aug. 10	0000-0315	3.25	
	Aug.11	0550-0730	2.33	
		1110-1600	4.83	
		2000-2400	4.0	
	Aug. 12	0000-0100	1.0	
41.190	Aug. 20	0710-2400	16.83	STS, released on Aug.17; stayed in Rm 1.8 to Rm 3.7 from Aug.23 to Sep.09; signal last heard at Rm 0.8 on Sep.10.
	Aug.21	0000-1900	19.0	
	Sep.09	0315-0500	1.75	
41.150	Aug.21	0200-1900	17.0	STS, released on Aug.11; stayed in lower river (Rm 0.3 to Rm 1.0) from Aug.11 to Aug.23; passed ladder on Aug.28.
41.150*	Aug.30	0100-0200	1.0	FCHN, released on Aug.29; signal heard in lower river (Rm 0.3 to Rm 1.0) from Aug.30 to Sep.01, Sep.14 to Sep.16, and on Oct.26; signal heard in ladder vicinity Sep.03 to Sep.10; signal last heard at Rm 1.8 on Nov.21.
		0630	0.17	
		1430-2400	9.5	
	Aug.31	0000-0630	6.5	
		1130-2300	11.5	
	Sep.01	0715-0730	0.25	
		0900-1310	4.17	
	Sep.13	1505	0.17	
	Sep.14	2000-2040	0.67	
	Sep. 15	0115	0.17	

Appendix Table B-l. Continued.

·equency	Date	Time	Total Hours	Comments
41.202	Sep.12	1820-1945	1.42	STS, released on Aug.17; stayed in lower river (Rm 0.1 to Rm 1.0) from Aug.17 to Sep.14; passed ladder on Sep.17.
	Sep.13	0125-0310	1.58	
	Sep.13	0700-0845	1.75	
	Sep.13	1130-2400	12.5	
	Sep.14	0000-1615	16.25	
40.650	Sep.03	1815-2400	5.75	STS, released on Ju1.15; stayed in lower river (Rm 0.1 to Rm 1.0) from Jul.15 to Sep.12 and returned from Oct.18 to Oct.27; signal heard in ladder vicinity (Rm 3.6 to Rm 4.0) form Sep.13 to Oct.14 and again from Oct.30 to Nov.17; signal last heard at Rm 0.3 on Nov.24.
	Sep.04	0000-1200	12.0	
		1445-1515	0.5	
	Sep.07	1745-1800	0.25	
	Sep.08	0030-0745	7.25	
		1915-2400	4.75	
	Sep.09	0000-0620	6.67	
		0840-1405	5.75	
		1630-1710	0.67	
		2000-2400	4.0	
	Sep.10	0000-0220	2.33	
		0500-0700	2.0	
		1200-1400	2.0	
		1650-2400	6.83	
	Sep.11	0000-0400	4.0	
		0830-0840	0.17	
		1145-1300	1.75	
	Oct.19	0100-0200	0.83	
		0910-1035	1.42	
	Oct.22	1120	0.17	
		2030-2040	0.33	
	Oct.23	0040-0100	0.33	
	Oct.24	0730-1835	11.08	
	Oct.25	2330-2400	0.5	
	Oct.26	0000-2400	24.0	
	Oct.27	0000-2400	24.0	
	Oct. 28	0000-0100	1.0	
	Nov.17	2330-2400	0.5	
	Nov.18	0000-0210	2.17	
41.230	Sep.16	0815	0.17	STS, released Sep.10; stayed in lower river (Rm 0.4 to Rm 1.1) until Sep.20; signal heard in vicinity of ladder (Rm 3.6 to Rm 4.0) from Sep.29 to Nov.17; signal last heard at Rm 2.8 on Nov.22.
	Sep.16	1400-1830	4.5	
	Sep.16	2030	0.17	
	Sep.16	2130	0.17	
	Sep.17	0740-0800	0.33	
	Sep.17	1130-1800	6.5	
	Sep.19	0030-0230	2.0	
	Sep.19	0740	0.17	
	Sep.19	1230-1600	3.5	
	Sep.19	2100-2300	2.0	
	Sep.20	0630	0.17	
	Sep.20	1145-1745	5.0	

Appendix Table B-1. Continued.

Frequency	Date	Time	Total Hours	Comments
41.252	Sep.28	2045-2300	2.25	STS, released on Sep.28; was in ladder vicinity (Rm 3.6 to Rm 4.0) from Sep.30 to Oct.3, on Oct.6, and from Oct.15 to Oct.19; signal heard near tailrace (Rm 0.9 to Rm 1.1) from Oct.22 to Oct.25; signal last heard on Oct.25 at Rm 1.1.
	Oct.21	2000	0.17	
41.270	Sep.29	2330-0045	1.25	STS, released on Sep.28; signal heard in ladder vicinity from Oct.2 to Oct.8 and from Oct.29 to Nov.11; signal heard in tailrace vicinity from (Rm 0.9 to Rm 1.1) on Oct.18 and from Oct.22 to Oct.24; signal last heard on Nov.27 at Rm 1.9.
	Oct.18	1535-1750	2.25	
	Oct.19	1245-1430	1.75	
	Oct.21	0400-0500	1.0	
		0745-0810	0.42	
		1230-1330	1.0	
41.292	Oct.4	0620-1335	7.25	STS, released on Sep.29; signal heard in tailrace vicinity on Oct.4 and Oct.5 and from Nov.7 to Nov.11; signal heard in vicinity of dam (Rm 3.6 to Rm 4.0) from Oct.12 through Nov.3; signal last heard at Rm 0.6 on Nov.15.
		1940-2050	1.17	
	Oct.5	0040-0130	0.83	
		0520-0715	1.83	
	Nov.7	1025-1205	1.67	
	Nov. 10	0720-2400	16.67	
	Nov.11	0000-0330	3.5	
41.220	Oct.5	1710-1915	2.08	STS, released Aug.26; signal heard in lower river (Rm 0.1 to Rm 0.6) from Aug.27 to Oct.6; signal heard in ladder vicinity Sep.9 to Oct.26 and from Oct.27 to Nov.27.
		2300-2400	1.0	
	Oct.6	0000-0020	0.33	
		0305	0.17	
41.330	Oct.13	1450-1700	2.17	STS, released Oct.13; signal heard near tailrace on Oct.14; signal heard near ladder vicinity from Oct.14 to Nov.11 and from Nov.13 to Nov.27.
	Oct.22	1320-2120	8.0	
	Oct.23	0300	0.17	
		0715-2400	16.75	
	Oct.24	0000-1715	17.25	
41.100*	Oct.30	1550-1715	1.42	STS, released on Oct.29; signal heard in lower river on Oct.30 and Nov.4; signal heard in ladder vicinity from Nov.6 to Nov.14; fish passed ladder on Nov.15.
41.110*	Nov.6	2220-2400	1.67	STS, released on Oct.28; signal heard in lower river from Oct.29 to Nov.6; signal heard in ladder vicinity on Nov.9, Nov.10, and from Nov.14 to Nov.27.
	Nov.7	0100-0130	0.5	
41.310	Dec.7	0745-2400	16.25	STS, released Oct.5; signal heard in lower river from Oct.6 to Oct.8; signal heard in ladder vicinity Oct.10 to Oct.12, Oct.17 to Oct.28, Oct.31 to Nov.17, Nov.26, and Nov.27.
	Dec.8	0000-0620	6.33	

APPENDIX C

Investigation of the Biodiversity of Oncorhynchus mykiss and O.clarki in the Vicinity of Mt. Hood and the Columbia Gorge

Progress Report 2/6/97

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Report

We initiated work on **June 1, 1996.** We have completed DNA extractions form the bulk of the samples. Our work is currently focused on two aspects of the project, development of microsatellite multiplexes and identification of species-specific DNA markers.

In accord with the **1996** Study Plan we initiated microsatellite analysis of samples from the study area. We have identified at least **10** microsatellite primer pairs that produce informative DNA fragments. We are currently in the process of combining these primers into "multiplex" sets to allow the amplification of three or four loci simultaneously. Wenburg et al. **1996** have previously developed four multiplex sets for these species. We are using their work to compensate for various thermocyclers and detection techniques, that work should proceed quickly.

Our initial microsate screening occasionally detected individuals that contain alleles well beyond the size range normally observed in the population from which they were sampled. This observation has been reported in microsatellite data and may simply be a result of a major mutation within the microsatellite locus in a few individuals. However, microsatellite allele size distributions frequently vary between species and **thus** these aberrant alleles may in fact be the result of hybridization. This raised some concern that some of our samples might be hybrids that were not visually identified as such and prompted us to focus on the development of species identification techniques in concert with our microsatellite screening.

We are utilizing two techniques to identify rainbow trout (Oncorhynchus mykiss), cutthroat trout (O.clarki), and their hybrids. The first technique, intron screening, is based on fixed restriction enzyme recognition site differences between the species in non coding DNA. John Baker, a University of Washington graduate student, is working with Paul Moran at the NMFS Montlake Lab to identify species specific markers using this technique. We are cooperating with them to generate these markers in the most efficient manner possible.

We are also using paired interspersed element PCR(PINE-PCR) to identify rainbow, cutthroat and their hybrids. This technique utilizes dispersed repetitive elements as PCR priming sites and amplifies DNA fragments flanked by two such elements. We have successfully used this technique to identify bull trout (Salvelinus confluentus), brook trout (S.fontinalis), and their hybrids. Our initial screening indicates that it will also be successful in Oncorhynchus. We have currently identified nine putative diagnostic PINE markers and are continuing to screen other primer pairs.

APPENDIX D

Pelton Ladder Data

Appendix Table D-l. Cell and pond location of 1994 brood spring chinook juveniles at Pelton Ladder and Round Butte Hatchery, 1995. (Ad = adipose, RV = right ventral, L = ladder, H = hatchery.)

Pond	Ship to ladder or pond	Pond or cell number	Size (fish/lb)	Number	Tag code-clip
H-1A	Oct.1	H-l	18.1	22,100	07-09-37-Ad
H-1B	Oct.1	H-2	34.5	33,118	07-09-36-Ad
H-7	Nov.13	L-l	13.6	66,181	07-09-35-Ad
H-2	Sept.25	L-2	21.4	63,916	07-09-33-Ad
H-3	Nov.15	L-3	14.2	63,782	07-09-34-Ad
H-10	Sept.28	L-4	29.7	63,784	07-11-30-AdRV
H-8	Sept.27	L-5	29.4	63,885	07-11-30-AdRV
H-4	Nov.14	L-6	24.3	95,885	07-09-38-Ad

Appendix Table D-2. Cell and pond location of the 1995 brood spring chinook juveniles at Pelton Ladder and Round Butte Hatchery, 1996. (Ad = adipose, RV = right ventral, L = ladder, H = hatchery.)

Pond	Ship to ladder or pond	Pond or cell number	Size (fish/lb)	Number	lag code-clip
H-1A	Oct.17	H-l	16.4	21,016	09-17-44-Ad
H-1B	Oct.17	H-2	26.0	31,552	09-17-45-Ad
H-5	Nov. 13	L-l	14.3	64,848	09-17-42-Ad
H-6	Oct.15	L-2	14.1	64,809	09-17-41-Ad
H-8	Nov. 13	L-3	22.0	96,643	09-17-46-Ad
H-2	Oct.15	L-4	14.6	64,752	09-17-47-AdLV
H-7	Oct.15	L-5	14.1	64,794	09-18-06-AdLV
H-10	Nov.13	L-6	11.9	64,750	09-17-43-Ad